Vol. 23 FEBRUARY, 1937 No. 2

International Journal of Orthodontia and Oral Surgery

Published by The C. V. Mosby Company, 3523-25 Pine Blvd., St. Louis, U.S.A.

Table of Contents on Inside Cover

International Journal of Orthodontia and Oral Surgery

CONTENTS FOR FEBRUARY, 1937

Orthodontia

Department of Oral Surgery

Department of Orthodontic Abstracts and Reviews

News and Notes

Vol. 23, No. 2, February, 1937. International Journal of Orthodontia and Oral Surgery is published by The C. V. Mosby Company, 3523 Pine Blvd., St. Louis, Mo. Subscription Price: United States, its Possessions, Pan-American Countries, $7.00; Canada, $7.50; Foreign, $8.50. Entered as Second-Class Matter at Post Office at St. Louis, Mo., Under Act of March 3, 1879.

International Journal of Orthodontia and Oral Surgery

Vol. 23 FEBRUARY, 1937 No. 2

Orthodontia

SOME STUDIES IN PALATOGRAPHY AND THEIR RELATION TO SPEECH AND ORTHODONTIA

NENA KATE RAMSEY, ABILENE, TEXAS

THESE studies were made by placing an artificial palate of vulcanized black rubber, dusted with a white French chalk, in the mouth and articulating the specific consonant. Then the palate was removed, placed upon the model, and a picture made.

My interest in the corrective phase of speech began when I was a student in Columbia University. Five years ago I went to London to study phonetics. There in the University College of the University of London, in the laboratory of the Phonetics Department under the direction of Mr. Stephén Jones, I began my study of palatography. The studies I bring to you are the result of the past five years of study and experience. I conduct a Speech Correction Clinic in connection with the public schools, and I have found that there is a close relationship between the objectives of the orthodontist and those of the speech correctionist. So I am grateful for this opportunity to discuss some of our mutual problems.

The objective of an orthodontist is to make the individual a physically fit member of society, and it is the aim of the speech correctionist to make him a mentally fit or socially adjusted individual. This is accomplished by teaching him to get and give meanings through acquiring the skill of producing and interpreting speech sounds. Speech is an acquired function, an overlaid function; but the primary function of the speech organs is biologic; i.e., functions of swallowing and breathing. Speech is the commonest means of communication; without a normal speech the inevitable social reaction is one of fear, suspicion, sullenness, introversion, and reclusiveness. Abnormal speech is any deviation from

Presented at the Thirty-Fourth Annual Meeting of the American Society of Orthodontists. St. Louis, April 20-23, 1936.

the norm which is sufficiently marked to call attention to itself and to stamp the individual as a deviate from normal social activities. Thus it is the business of the speech correctionist to produce normal speech because there is no desirable

A.

B.

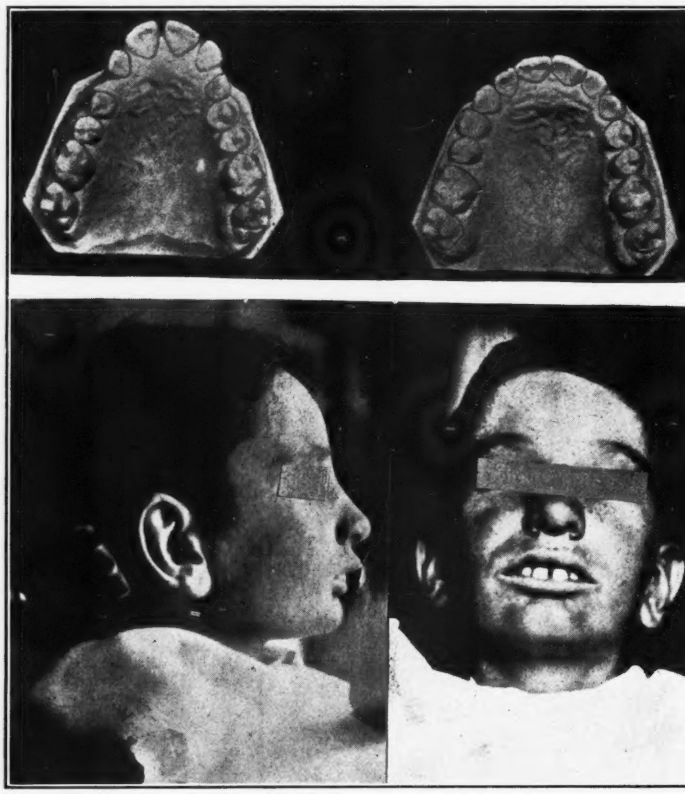


Fig. 1.—*A*, Protruding anterior maxillary teeth, and occlusion corrected. *B*, Photographs of patient with protruding anterior maxillary teeth.

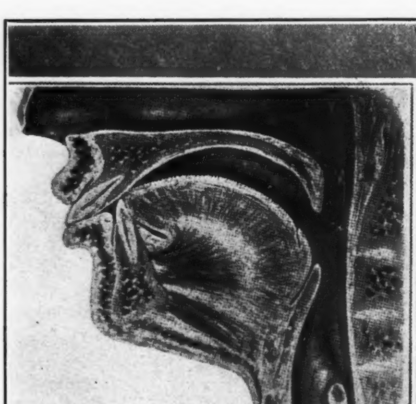


Fig. 2.

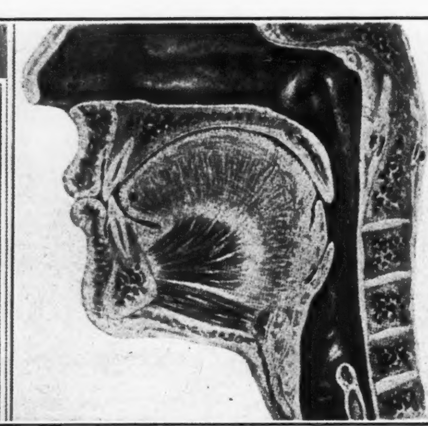
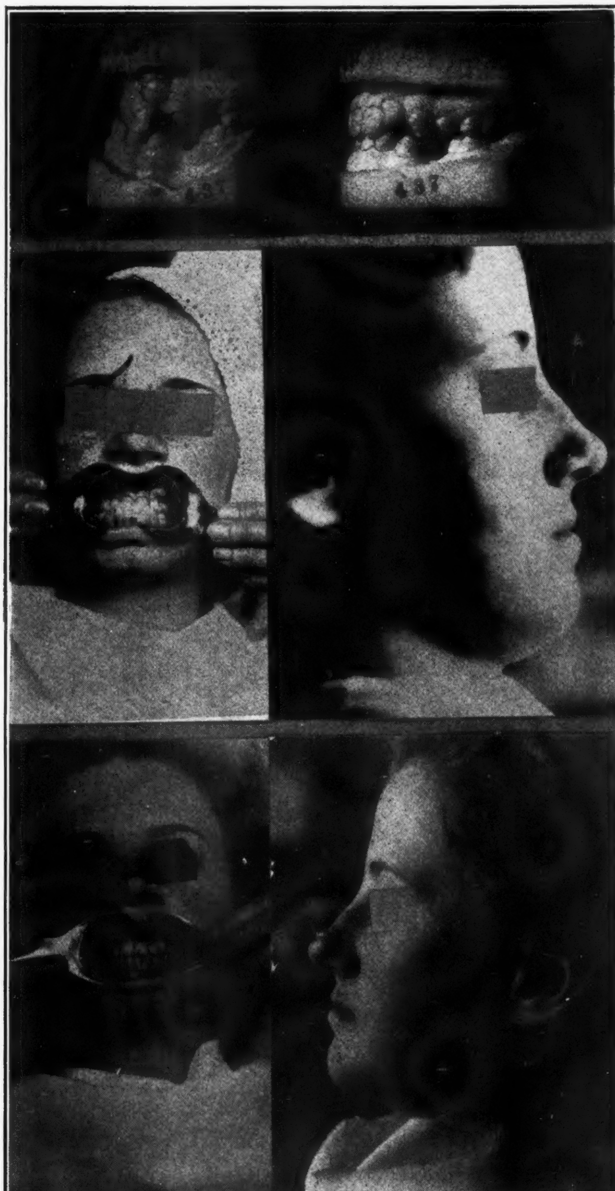


Fig. 3.

Fig. 2.—Protruding anterior maxillary teeth, cross-section.
Fig. 3.—Occlusion corrected.

place in society for a person who is mentally unfit. At least 80 per cent of the lispers I treat have a malformation and are in serious need of orthodontic treatment.

In tabulating the results of a series of questions I sent to a number of orthodontists, I find that with two exceptions they all agree that, where there was a need for orthodontia, they also found an accompanying need for social adjustment. In answer to another question, "Have you found cases in which you



A.

B.

C.

Fig. 4.—*A*, Receding anterior maxillary arch with an overdeveloped mandibular arch. *B*, Photographs of patient with receding anterior maxillary arch. *C*, Photographs of same patient with occlusion corrected.

thought corrective speech should supplement orthodontia?" more than 60 per cent answered in the affirmative. Dr. Raubicheck told you last year that in a group of two hundred lispers she found that 90 per cent showed a marked malocclusion. Speech is not a static process, it is a live, dynamic activity; it is

a learned process. Even if the orthodontist has corrected the malformation, the old speech habits will remain unless a new unity, new patterns are set up, a new unified and coordinated whole. Thus the necessity for corrective speech training or, better still, the need for speech reeducation as a supplement to orthodontia is evident.

The malformations most commonly found detrimental to normal speech are protruding anterior maxillary teeth with an underdeveloped mandibular arch

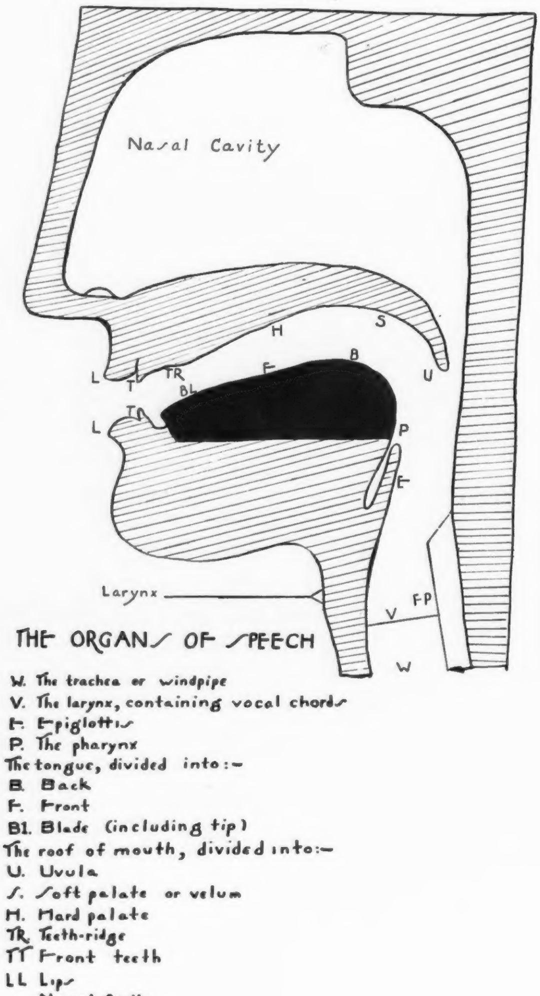


Fig. 5.—Organs of speech.

(Fig. 1 *A*) and a receding maxillary arch with an overdeveloped mandibular arch (Fig. 4 *A*). Frequently in the first type the mandibular teeth articulate with the rugae or teeth ridge. I call especial attention to that to show you later how it interferes with normal speech. The *t, d, n, l, r, th, sh,* and *ch* are made by the tongue articulating with the teeth ridge or rugae at some point. With the mandibular teeth retracted far enough to articulate with the teeth ridge, there is not space left for the tongue, so the tongue protrudes, filling all available openings. This makes for indistinct speech and poorly phonated consonants.

To understand this paper one should have an elementary knowledge of the organs of speech. Fig. 5 is a very simple chart, but it is sufficient to give an elementary knowledge of the construction of the speech organs and how they are used in the formation of speech sounds. The movable organs of speech are the vocal chords, the soft palate, the tongue, and the lips. The following palatographic studies of the palate involve tongue movements and not the other movable parts of speech. However, for the orthodontist the lips are of considerable importance, and for the oral surgeon the soft palate and the uvula are of interest.

Fig. 6.—*T.*

Fig. 7.—*D.*

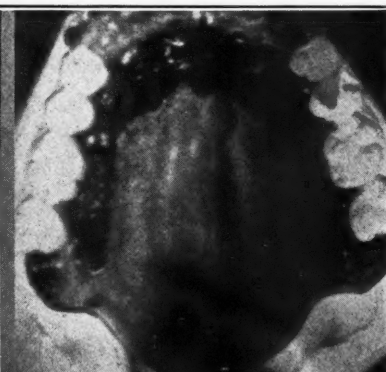
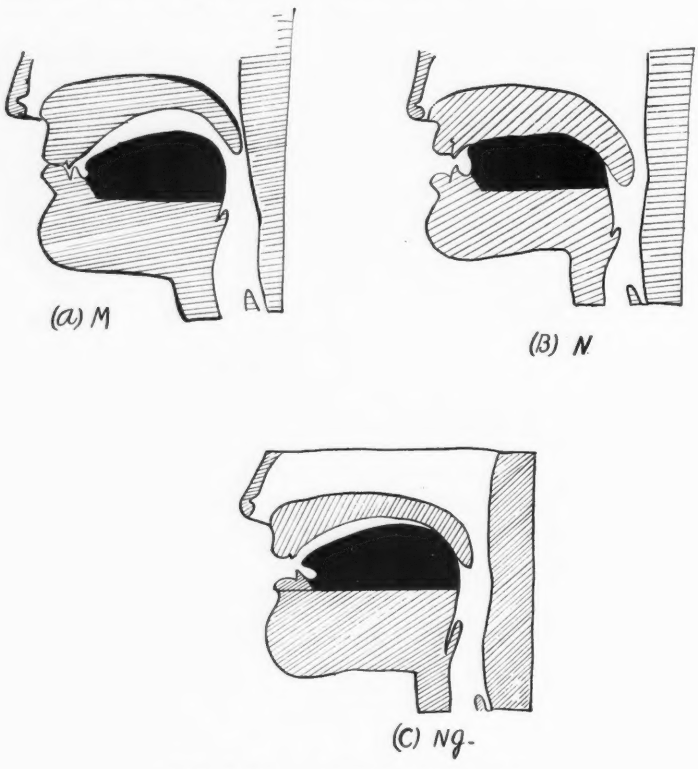


Fig. 8.—*N.*

There are eighteen consonants formed by some part of the tongue articulating with some part of the hard palate. This article contains palatographic studies of eighteen consonants. In English there are two *l* sounds: a clear *l* and a dark *l*. The word *little* contains both; the initial is a clear *l* and the final a dark *l*. The articulative process is the same for both, but the difference occurs in the position of the back of the tongue; so only one palatogram of *l* is necessary (Figs. 16 and 25). Figs. 6 to 23 are palatograms of all the tactile consonants, those which are produced by the tongue articulating with the hard palate. Figs. 24-27 show tongue positions while the above consonants are in the process of articulation.

There are eight English consonants that are made by the other movable organs of speech. The *p*, *b*, and *m* are made by the two lips stopping the air, then

releasing it suddenly (Figs. 24 *a* and 9 *a*). If the individual is a type found in Fig. 1 *B*, it will not be easy for him to bring the lips together for ordinary speech purposes, and as a result the bilabial consonants, *p, b, m,* will be made where the labiodental consonants are made for normal speech. The *f* and *v* are labiodental consonants and are produced by the maxillary anterior teeth articulating slightly against the lower lip (Fig. 27 *a* and *b*). The voiced and voiceless *w* consonants are made by rounding the lips and producing a sound with audible friction. The *h* is a glottal fricative sound that is made by the air passing through the open glottis. For all these consonants the tongue is in a position for the vowel which follows. For instance, in pronouncing the word *he,* while the *h* is being made in the glottis, the tongue assumes the position for *e*.



NASAL CONSONANTS

Fig. 9.

If a person has the kind of malformation as illustrated Fig. 1 *A*, the arch is so high, narrow, and constricted that frequently the tongue cannot reach the rugae or hard palate to articulate the palatal consonants; consequently there will be substitutions made for original sounds. As a result the individual will develop one of the commonest speech defects, a lisp; frequently this leads to embarrassment, and gradually the person becomes a disintegrated member of society. The worst kind of speech disorder gets a foothold, and stuttering becomes a habit. If the orthodontist widens and lowers the arch and the tongue is brought into normal relation to the hard palate, with a little special attention the speech can be corrected. In Fig. 4 *B* there is not enough space for the tongue. Often after proper occlusion has been gained, the old habit remains the same until new

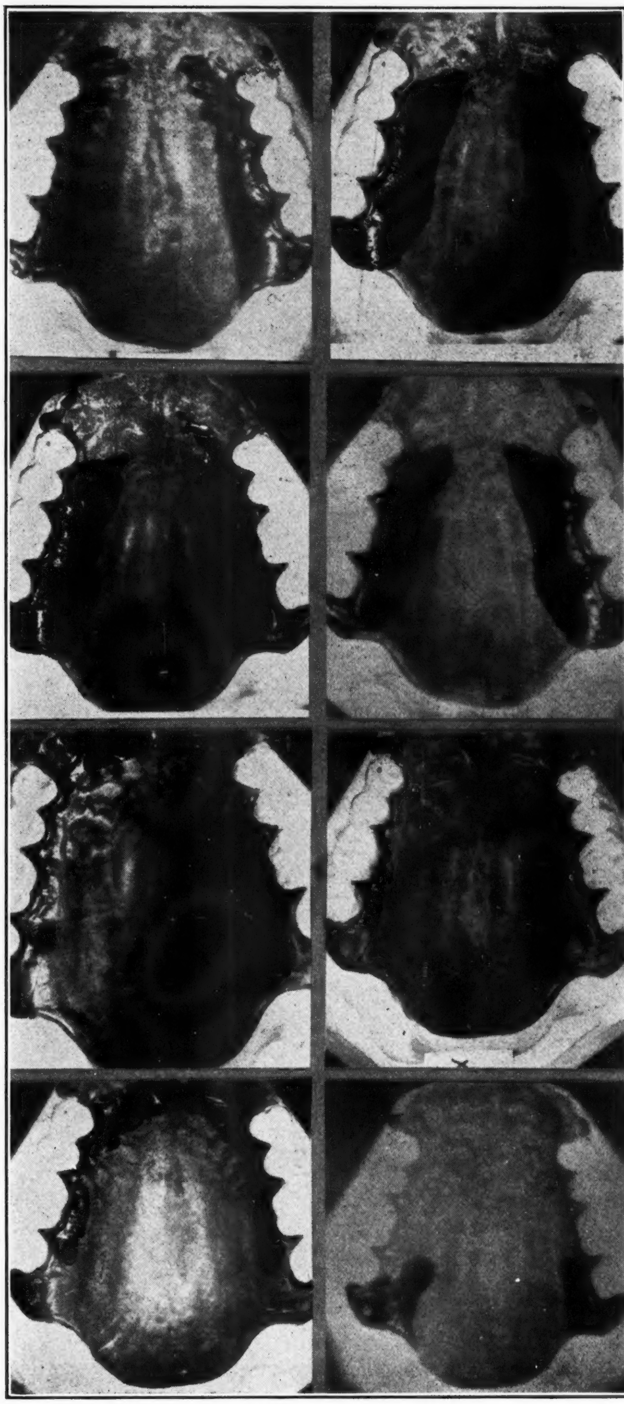


Fig. 10. Fig. 11.
Fig. 12. Fig. 13.
Fig. 14. Fig. 15.
Fig. 16. Fig. 17.

Fig. 10.—*S*. Fig. 11.—*Z*.
Fig. 12.—*Sh*. Fig. 13.—*Zh*.
Fig. 14.—*Th* (voiceless). Fig. 15.—*Th* (voiced).
Fig. 16.—*L* (clear). Fig. 17.—*R* (fricative).

speech patterns are established. In Fig. 4 *C* correct occlusion has been obtained, but the tongue is still pressing through all open spaces.

Another factor of great importance in normal speech is the correct use of the soft palate. In English there are only three nasal sounds, the *n, m,* and *ng.* They are formed by closing the mouth passage at some point, and at the same

Fig. 18. Fig. 19.
Fig. 20. Fig. 21.
Fig. 22. Fig. 23.

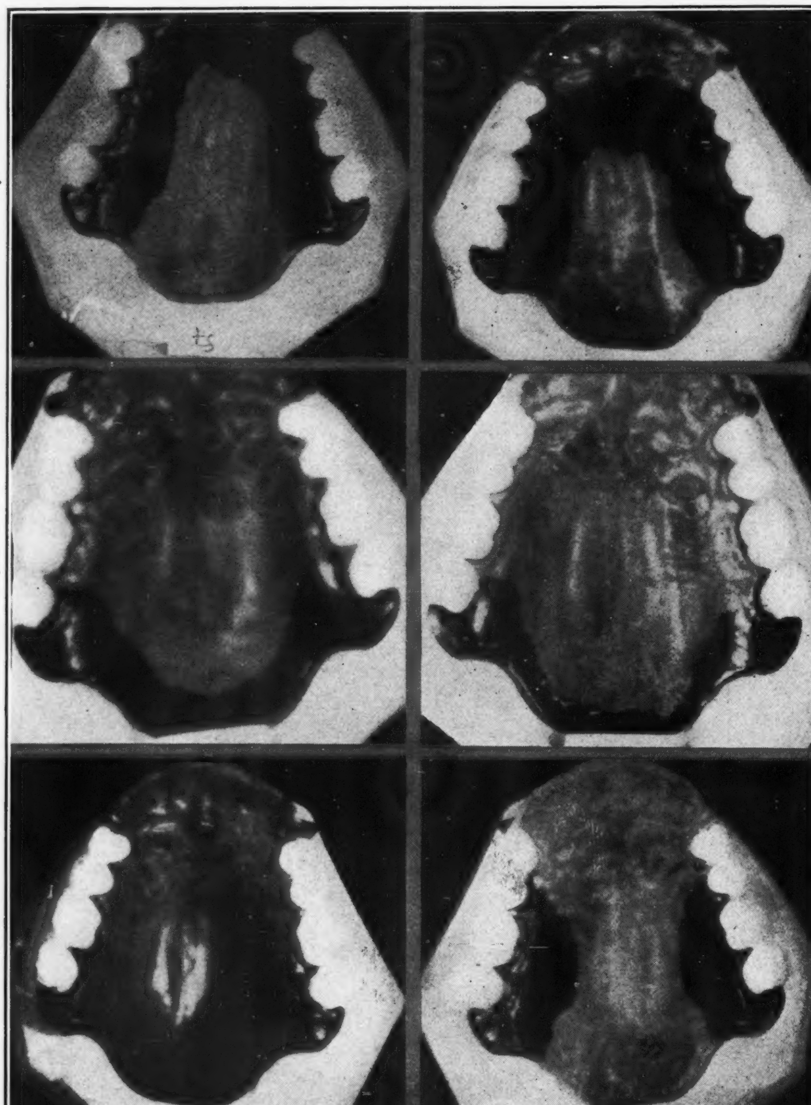


Fig. 18.—*Ch.* Fig. 19.—*J.*
Fig. 20.—*K.* Fig. 21.—*G.*
Fig. 22.—*Ng.* Fig. 23.—*Y.*

time lowering the soft palate so that the air can be emitted through the nose (Fig. 9). For all other sounds the soft palate should be raised against the post-nasal pharynx. Nasalized vowels do not occur in good English, and, when they do occur, they mark the speech as one with a dialectal peculiarity. If the uvula velum is too long or too large, it will become a handicap to normal speech. Oc-

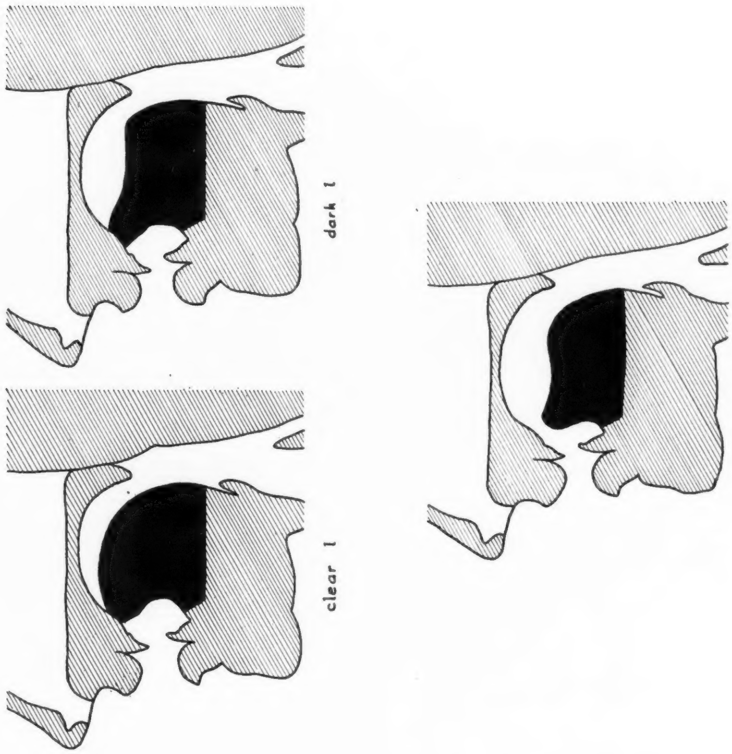


Fig. 25.

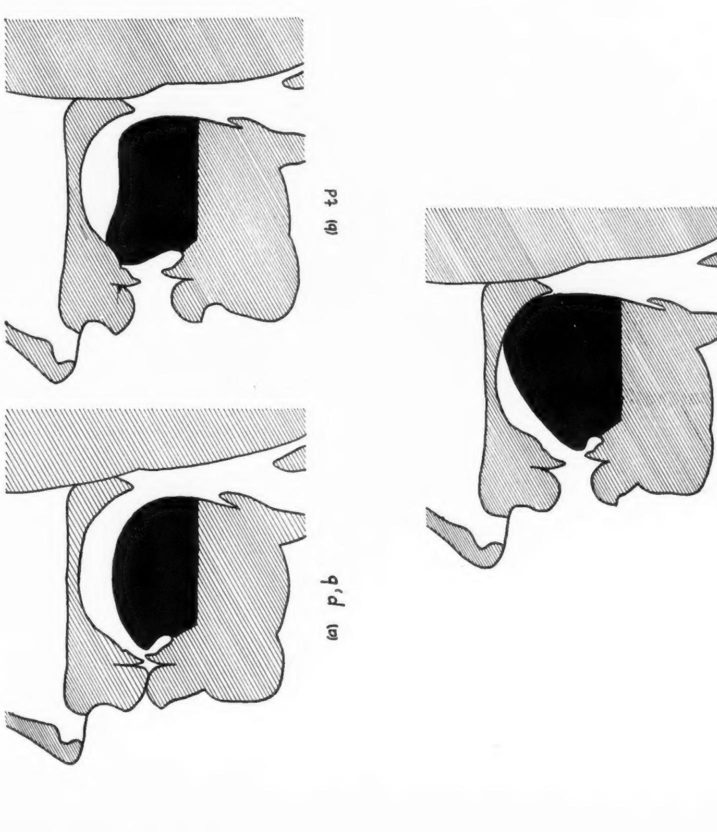


Fig. 24.—English plosive consonants.

casionally the uvula is removed, and there are movements that compensate for its absence; in that case there is no trace of nasality.

In most instances both speech training and orthodontic treatment are prohibitive. But while orthodontic treatment is in the process, if the orthodontist suggests some specific tongue and lip exercises that will be helpful to his patient's

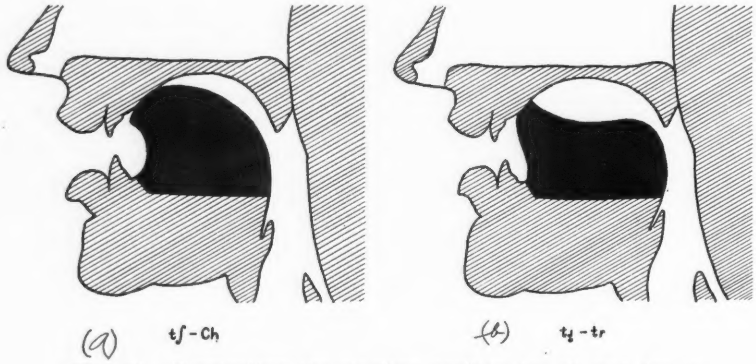


Fig. 26.—Illustrating the starting position for *ch* and for *tr*.

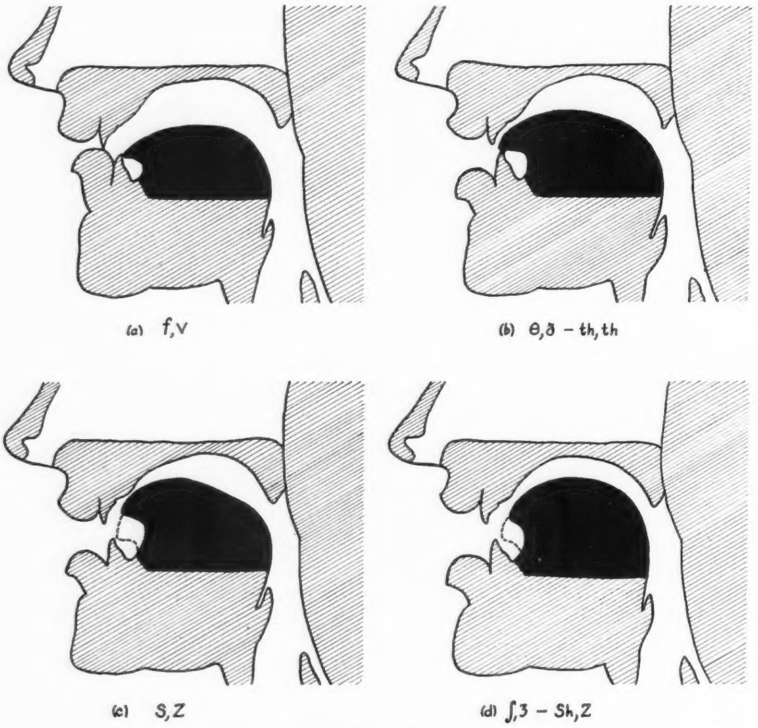


Fig. 27.—Fricative consonants.

speech activities, he not only will be improving the patient physically but will be helping his patient to become socially integrated and a more valuable member of society.

DISCUSSION

Dr. Alfred P. Rogers, Boston.—Yesterday it was my great pleasure to congratulate an essayist on his understanding and application of myofunctional therapy in the treatment of

various classes of malocclusion. This morning it is my pleasure to congratulate another essayist for her understanding and help in creating another salient, an important one to the work on myofunctional therapy. This work of Miss Ramsey's ties up so closely with the normal development of the individual through the mental control of the muscular elements that it is truly a remarkable addition to our work.

I should like to suggest to Miss Ramsey that she take plenty of time to prepare this paper for us, and give us at least all she has shown on the screen in addition to her printed manuscript because I think every member should make a particular study of this paper. To me it is one of the most important that has been given to us in a long time as it should, if well understood, eventually assist us in further reducing the application of appliances.

I know nothing about the correction of speech defects, but I have seen such defects corrected in my own practice when the child has learned to use the muscular elements of the face correctly through the aid of a proper system of exercises.

I am grateful to Miss Ramsey because she has given a further means of understanding, thereby increasing the scope of our usefulness to children. That is why I urge her to make this contribution just as comprehensive as possible so that every one of us may understand it.

Dr. Vilray P. Blair, St. Louis.—I need not tell you that it is always a pleasure for me to meet you again, and I am especially glad to see you in St. Louis.

In addition, I came particularly to hear Miss Ramsey's talk. I will not say that I was pleased with it because it would be rather foolish to say so. You will find, I think, more often in surgery than in dentistry that occasionally some outsider will rise up and offer constructive criticism of results about which we are inclined to be a bit too complacent.

In the matter of speech, both Kingsley and Gutzmann were outstanding examples who are world famous for what they accomplished in their time, and now Miss Ramsey brings us new inspiration that will beget higher ideals. We all are fortunate to have had this opportunity of hearing her very dramatic and concise presentation.

AN INTRODUCTION TO CLASS III MALOCCLUSION OF THE TEETH AS A PART OF THE GENERAL PROBLEM IN ORTHODONTIA

MILO HELLMAN,* D.D.S., SC.D., NEW YORK, N. Y.

BEFORE venturing upon a discussion on the subject of Class III malocclusion there are three confessions I wish to make. One is that, looking at the problem which orthodontia presents to me now, I am bewildered by its magnitude and complexity, and disturbed by the rampant ignorance of its implications. The second is that, in attempting to get to the bottom of the problem, I am confused by the ramifications of the intricate byways which sidetrack one from the path leading to a clear understanding. And the third is that, in seeking a solution of the problem, I am astonished and surprised by the remarkable achievements duly credited to the mechanical devices used in orthodontic procedures. Under such circumstances I was rather dubious about the need of another paper even on this special phase of orthodontia. Moreover, since most of our knowledge really deals with what is known and, to be sure, there is much that is known in orthodontia, I should hesitate to look for more. The records of practical experiences again already abound with results which are successful. There would accordingly also be little gained by adding on more to those already available. It then occurred to me that most successes are so spectacular and dazzling as to make one dizzy. Under such circumstances it is easy to forget that the number of successes alone has at no time entirely accounted for all the cases treated. What is even more interesting is that of the successes reported not all remain successes very long thereafter. Since it is not customary to report them again, particularly if they happen to go wrong, the first record stands on its merits, whatever they may be.

This, however, is not the point I really wish to make. I merely mention it, because it gave me a happy idea. It appeared to me that there might be something gained if I were to reverse the customary procedure and approach the subject backward. That is, it would be quite a novelty and perhaps a useful one to deal with the topic from the point of what I did *not* know and illustrate it with examples of such achievements as are the results of conditions beyond my control, and for which I could reasonably be neither praised nor blamed. To that end I shall begin with actual experiences in order to point out: (1) that satisfactory practical results are obtainable by empirical methods, provided the mechanical devices are efficient and skillfully handled, disregarding the problem entailed; (2) that the baffling part of the problem, which bothers us either before or after treatment, has nothing to do with the actual attainment of desirable results; and (3) that, in making a clear distinction between what we can

Read at the Thirty-Fourth Annual Meeting of the American Society of Orthodontists, St. Louis, Missouri, April 22, 1936.

*Professor of Dentistry, Columbia University School of Dental and Oral Surgery; Research Associate in Physical Anthropology, American Museum of Natural History, New York.

definitely do and what we actually know, it may be possible to throw some light on the nature, magnitude and significance of the problem we are actually grappling with.

Of course, every one knows what Class III malocclusion is. Angle[1] defined it some thirty or more years ago, and none of his followers were in doubt about it. "Class III Division 1," says Angle, "is characterized by mesial occlusion in both lateral halves of the dental arches. The extent to which the mesial occlusion must exist in order to place the case in the division of this class is slightly more than one-half the width of a single cusp on each side." This definition seemed to suffice, because up to a certain time most of us knew what Class III stood for. Whether the terms *mesoclusion* proposed by Lischer,[2] *lower protraction* proposed by Simon[3] and endorsed by McCoy[4] and others made any difference in understanding what is meant I do not know. What I have reference to is Class III as defined by Angle. But, to make it more accurate, the occlusion is determined by the lingual, not the buccal, cusps of the maxillary premolars and molars in their occlusal relation to the mandibular. The reason for it was given in a paper in 1920[5] intended to clear up certain complications which often lead to confusion.

For the present purpose the tentative assumption is made that Class III is a problem in malocclusion and that orthodontic treatment is a means for its proper solution. To this end the dentition alone will be dealt with, and the face in its physiologic setting of development will be left for a future occasion.

As fate would have it, I was fortunate enough to start orthodontic practice in a way that properly fits this occasion. It thus happened that my first orthodontic patient had Class III malocclusion of the teeth. Fortunately for me, it was a patient who came from my own dental practice. There was a good deal of comfort in this. Although I knew more about orthodontia then than I know now, it was a relief to be under no supervision and subject to no criticism by any of my confreres. The whole responsibility toward the patient rested with me, and my ambition was to make a good job of it. For this reason I am obliged to give a detailed account of the case. Besides, there are two advantages to be gained. One is to show how I went about it, and the other to demonstrate the very excellent result I was able to obtain in the treatment of this Class III case. Although it may look something like a case report, I shall risk the odium of indifference by showing just what I did, how I did it and what it turned out to be after I finished doing it.

The patient was a boy approximately fourteen years of age. The dentition, as shown in Fig. 1, was in Class III malocclusion (Angle). Of course, I am fully confident that most of us will agree that it is a Class III, regardless of other terms which may be applied to it. In those bygone days such conclusions were reached by simply looking at the occlusion of the permanent first molar teeth. But, while classifying the occlusion of the teeth, we also thought that the diagnosis was made. The prognosis too was then mostly favorable and treatment always indicated. As seen in this illustration, besides the condition of malocclusion there were some other peculiarities. All the deciduous teeth were lost, but not all their successors were present. The maxillary right canine and the mandibular left first and second premolars were still unerupted. This in-

dicates a retardation in eruption of those teeth. There was more than sufficient room for the mandibular left premolars, but not enough for the maxillary right canine. The space for the canine was completely closed, the maxillary right lateral incisor approximating the maxillary right first premolar. The mandibular dental arch was not only larger than and anterior to the maxillary, or vice versa, but the maxillary was also halfway lingual to the mandibular. The buccal cusps of the maxillary premolars and first molars thus occluded with those points in the mandibular teeth where the lingual cusps should be. There were also some enamel hypoplasias of the cusps of the permanent first molars, indicating a congenital disturbance in enamel formation. The forward slant of the maxillary incisors, though not desirable, had no special significance at that time. We knew that nature corrects that after the occlusion is restored to normal. The treatment was started in January, 1909. The qualifications needed for handling a case of this sort were quite fully met by the fact that I had just received from the Angle School the certificate for having completed in a satisfactory manner a course of instruction. But that had nothing to do with my ambition, zeal and enthusiasm. Nor did it matter much that I had no experience at all. In February, 1910, a year later, the progress made was interesting, but somewhat disturbing. As shown in Fig. 2, the normal anteroposterior as well as the buccolingual relationship was established on the right side. On the left side, however, I accomplished too much. The mandibular permanent first molar on that side was now in distal relationship to the maxillary. The space in front of it which was, to begin with, too large for the premolars was increased by 6 mm., and the incisor occlusion was now in an openbite. The space for the maxillary right canine was opened considerably, but not enough to accommodate the tooth. All the maxillary incisors were tilted forward more than before and the mandibular first molars tilted backward. I might be frightened by such results now, but then it was different. In the first place, the word failure did not exist, and then there were some new appliances being invented which would solve all our troubles.

Thus, having recognized the fact that with the plain expansion arch mechanism the limit was reached, I at once adjusted the pin and tube appliances just then developed. This mechanism was not on very long when I discovered that the maxillary right central incisor was devitalized. Being the first incident of this sort, it also was the end of that mechanism as far as I was concerned. Sadder but wiser, I went back to the previous type of appliances. But, while doing that, I made some improvements by adapting the old appliance to the new principles needed for root movement. In the light of the experience gained, however, I was careful to make these adaptations simpler in form, easier in application and gentler in action. After four more years of intensive treatment, including a year's retention, the very gratifying result shown in Fig. 3 was obtained. In the meantime the maxillary canine and the mandibular left premolars had erupted and taken their place. But the premolars and maxillary right central incisor had to be rotated. The retaining bands for those teeth are still on, because it was said that rotated teeth easily relapse. So, in order to make sure, I held on long after the other retaining appliances had been removed.

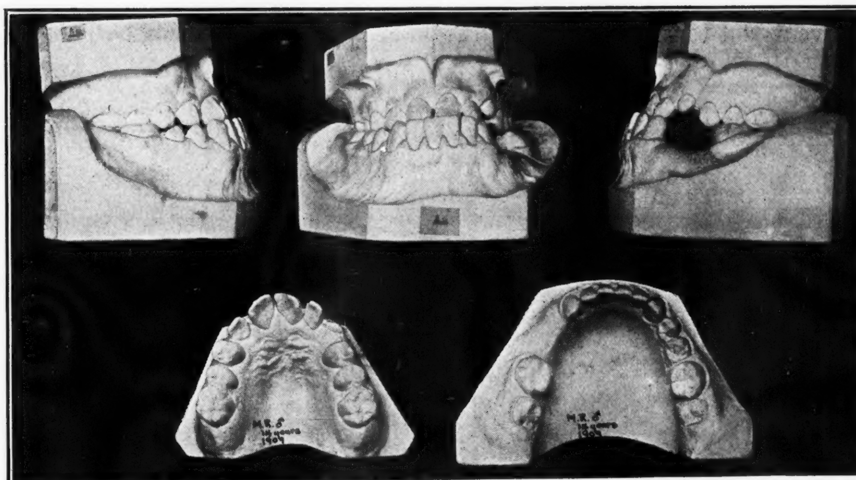


Fig. 1.

Fig. 2

Fig. 3.

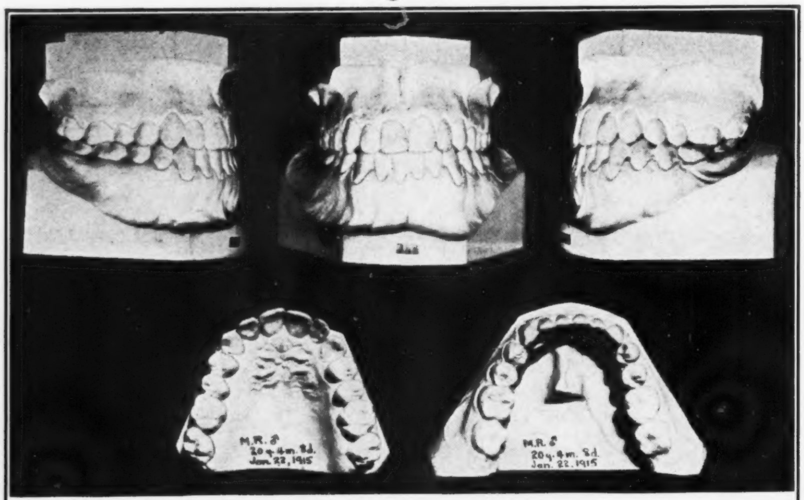
Fig. 1.—Casts of dentition of boy, aged fourteen years, showing Class III malocclusion. Unerupted teeth: maxillary right canine and mandibular left first and second premolars. Space for maxillary right canine closed.

Fig. 2.—Casts of dentition of same boy as in Fig. 1, showing progress of treatment one year later. Unerupted teeth still absent.

Fig. 3.—Casts of dentition of same boy as in Fig. 1, four years later, showing the occlusion at completion of treatment.

The result thus shown was a howling success. I was proud of it, and rightly so. I have as yet to see a better result. Is such a success lasting? This question was at no time a favorite one. I did not put it to any one, but it never stopped bothering me. A year later (1915), the casts shown in Fig. 4 were obtained. The boy was then twenty years of age. With the exception of the slight rotation of the maxillary right central incisor, which relapsed a bit, the result was still very successful and highly gratifying. I was then confident that I knew how to

Fig. 4.



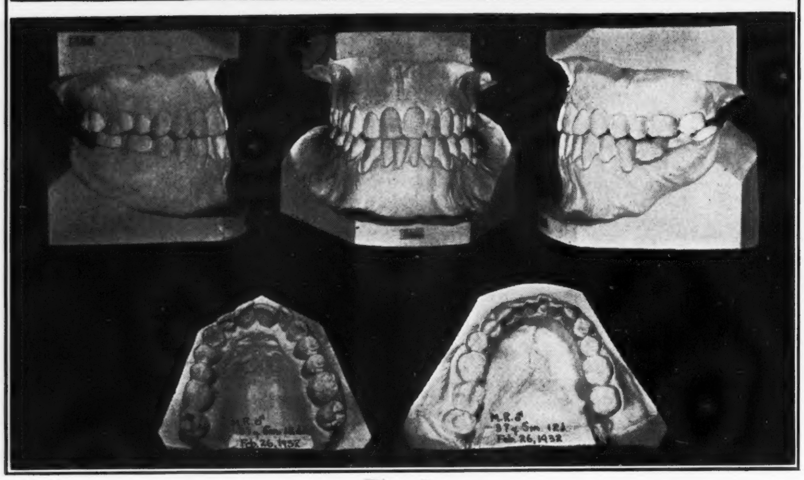


Fig. 5.

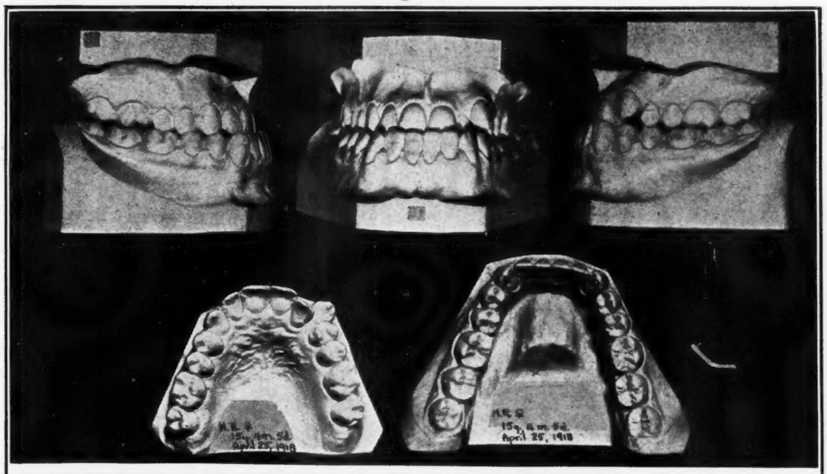
Fig. 4.—Casts of dentition of same boy as in Fig. 1, one year after discarding all appliances, showing the result in perfect condition.

Fig. 5.—Casts of same dentition as in Fig. 1, eighteen years after discarding the appliances, showing relapse to original condition on the right side and the tendency to relapse on the left side.

treat Class III cases, not only because this one turned out so satisfactorily, but also because other and similarly complicated Class III cases which came under my care were attended to with the same measure of success. I was perhaps more fortunate than others to treat such difficult cases early in practice. In fact, during the first few months, three Class III cases were under my care and the outcome was equally good.

Meanwhile "Time marches on." In 1932, seventeen years later, I happened to be driving through the Adirondack Mountains. At a certain place I noticed a hiker resting by the roadside. After passing I thought I knew him. I turned back and asked whether I could give him a lift. He was agreeable and got into the car. I knew him and he recognized me. It was my first Class III case. On parting I invited him to call at my office. He did. I took impressions, the

Fig. 6.



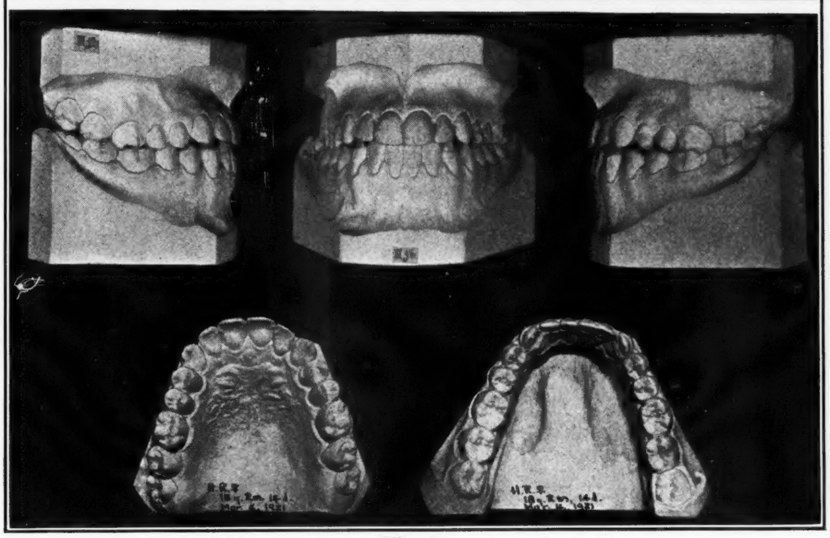


Fig. 7.

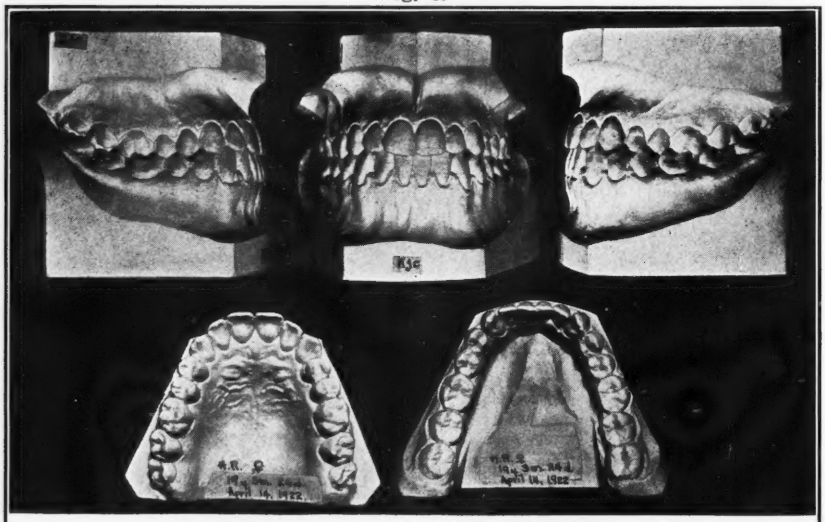
Fig. 6.—Casts of dentition of girl, aged fifteen years, showing Class III malocclusion. Mandibular third molars already erupted.

Fig. 7.—Casts of same dentition as in Fig. 6, three years later, showing occlusion at completion of active treatment. Maxillary third molars erupted; retention is continued.

casts of which are shown in Fig. 5, presenting the dentition eighteen years after the appliances had been removed. While I was thrilled by the experience of making such an addition to the previous records of this case, I have been puzzled by it ever since. I thought I did very well with it. If I were asked for an unbiased opinion on the occlusion of the dentition as shown by these casts now, I would say that it is a Class III case with an edge-to-edge bite.

Another Class III case is shown in Fig. 6. This patient was a girl fifteen years old, but the dentition was much older. As shown in these casts, the mandibular third molars were already fully erupted. This girl was thus considerably accelerated so far as the eruption of the mandibular third molars indicated. The maxillary teeth which were normal according to eruption were abnormal in their position. The maxillary dental arch was diminished in size

Fig. 8.



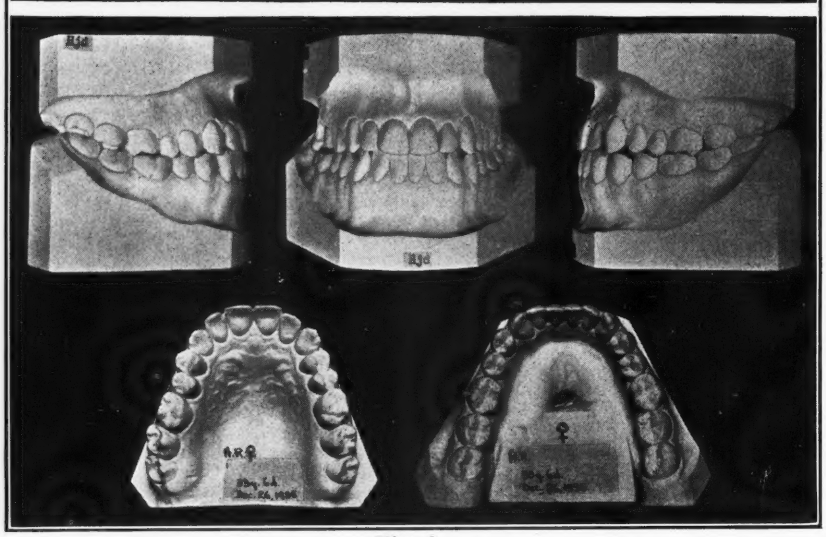


Fig. 9.

Fig. 8.—Casts of same dentition as in Fig. 6, one year after all appliances were discarded, showing normal occlusion still maintained.

Fig. 9.—Casts of same dentition as in Fig. 6, fifteen years after discarding of appliances, showing tendency to drift back to Class III.

and lingual in position, with the maxillary left canine projecting labially. In the treatment of this case, as shown in Fig. 7, the same kind of gratifying result was obtained. It took three years of active treatment and one year for retention to bring it about. In the meantime, the maxillary third molars erupted and assumed their normal relationship to the mandibular. A year later, as shown in

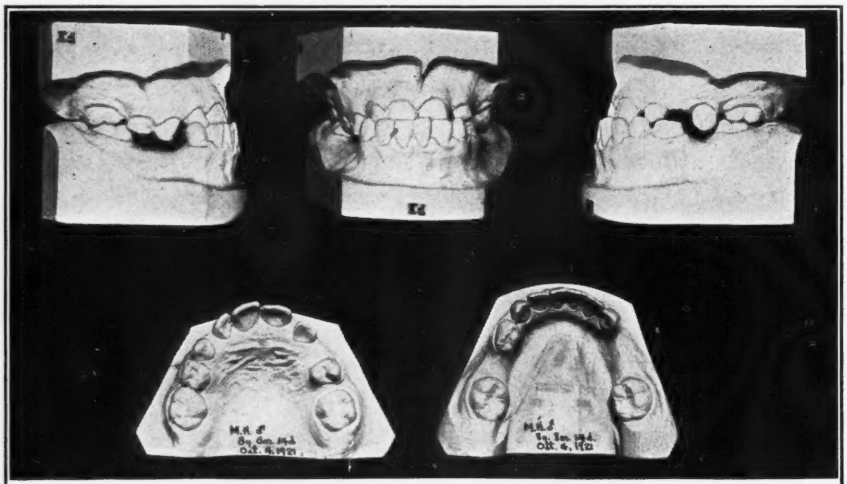
Fig. 8, the occlusion was still holding its own. Fifteen years later the dentition looked as shown in Fig. 9. While still quite satisfactory, there is again a tendency toward drifting into Class III, the occlusion of the teeth being now halfway there. Besides this, the maxillary right second premolar and first molar are in lingual occlusion.

My object in showing these two cases is to furnish some evidence in support of my conviction that the treatment of such cases, so far as my experience goes, is not difficult. The other cases which cannot be shown now also prove that excellent results are always obtainable in the treatment of Class III malocclusion. But what I am concerned about is: why, long after treatment, do the teeth continue to drift back toward what was started out with? Of course, I am quite aware of the fact that there are many explanations, but the trouble is that no explanation will quite explain if there is no proof to support it. There are, for example, some of us who believe that early treatment is an explanation. The treatment of these cases was started at fourteen and fifteen years of age respectively. There are many arguments advanced in support of such explanations. I am on this account obliged to show some more cases, because they will bear evidence as to the reliability of arguments.

In Fig. 10 is shown the dentition of a boy eight years of age. The malocclusal condition is not quite so extreme a Class III as were those shown before, but it is complicated by other difficulties. Thus, while the mandibular permanent first molars are only about halfway anterior to the maxillary, there are deficiencies in the maxillary dental arch not so easy to overcome. Both maxillary second premolars are unerupted, the space on one side is completely, and on the other more than half, closed up by the forward tilt of the maxillary first molars. In the mandibular dental arch, on the contrary, the spaces for the unerupted first and second premolars are more than enough. The treatment, including the retention period, was longer than in the other cases. It took five years altogether, but the result, as shown in Fig. 11, when the appliances were discarded, was satisfactory. One year later, Fig. 12, the occlusion was still holding its own. But four years later, Fig. 13, when the boy was eighteen years old, it had drifted into a complete Class III on the left side, the right side being halfway normal in occlusion. Another and more interesting case is shown in Fig. 14. In this case, a boy eleven years eight months old, the dentition was not completely in Class III malocclusion. It was just drifting into it. In addition to this, the maxillary left lateral incisor, canine and both premolars were in lingual occlusion. The mandibular left canine and premolars were spaced. It seemed to be a very simple case, but it took two years and four months to bring about the change shown in Fig. 15. Five years after dismissal, the casts shown in Fig. 16 were obtained. The case was completely in Class III malocclusion. The boy was then nineteen years old and, as shown in the illustration, had all four third molars fully erupted, which may be interpreted as an association of accelerated development in eruption of the teeth with an increase in size of the mandible. In body size too he was quite accelerated, being 71¼ inches tall and 170¼ pounds in weight. The average for this age is 70 inches and 145 pounds.

I shall at this time make a digression to explain that eruption is not merely an indication of getting teeth. It is the expression of certain processes of life which take place in the course of growing up and, like other similar processes, is understood to be due to biochemic combinations which produce physiologic changes that stimulate development. But, since development is not uniform in different structures at the same time and in the same structure at different times, it is obvious that anatomic differences are but a natural consequence of a normal

Fig. 10.



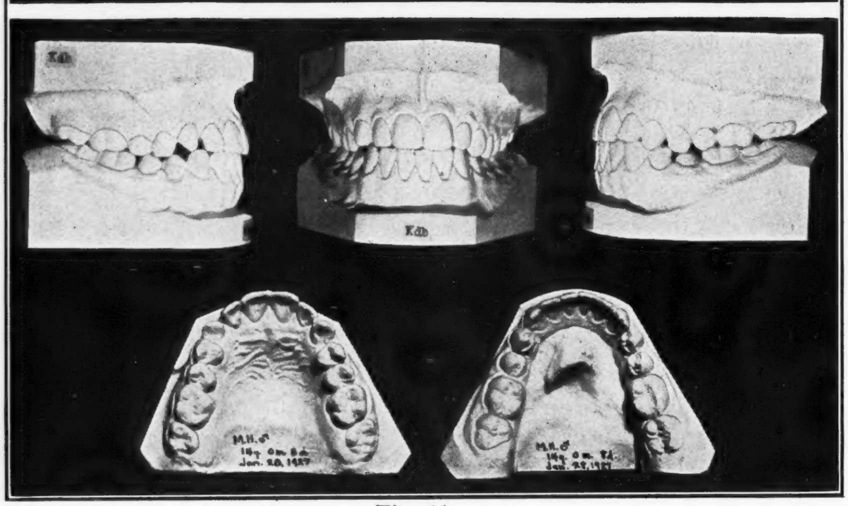


Fig. 11.

Fig. 10.—Casts of dentition of boy, eight years eight months of age, showing Class III malocclusion.

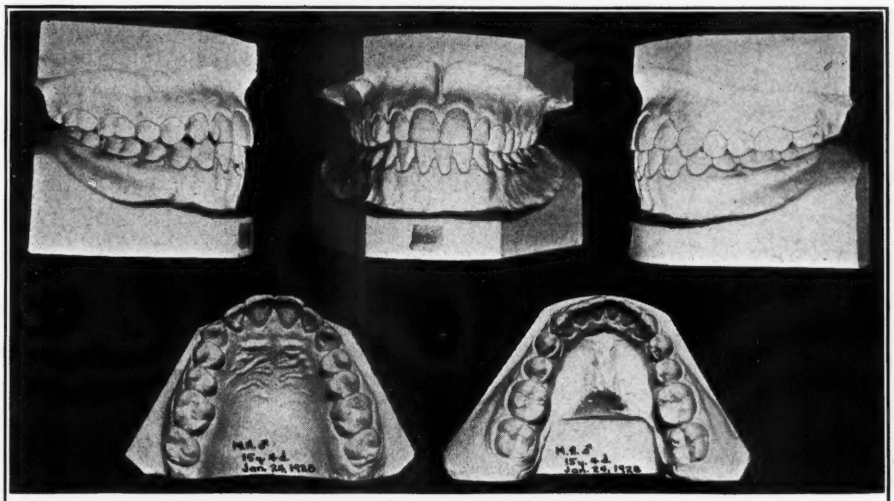
Fig. 11.—Casts of same dentition as in Fig. 10, five years three months later, showing excellent result of treatment.

course of events. It should, however, be mentioned that these chemical and physiologic changes do not really initiate anything new but just emphasize something old. Since these changes occur at certain intervals and since they become noticeable by an initial impulse, they are referred to as growth spurts. Such spurts are known to occur at stages of development when newly added elements enter the old circle of the hormonic family or when new combinations in

old circles occur or fail to occur. The time when this happens among our patients is mostly at puberty or adolescence. But since females develop at a faster pace than males, it is obvious that the spurts also occur earlier.

To return to our topic, one more case will be shown to complete this picture with which we started out. This case is of greater interest, since it furnishes the necessary means to a certain extent for an experimental study. Of course,

Fig. 12.



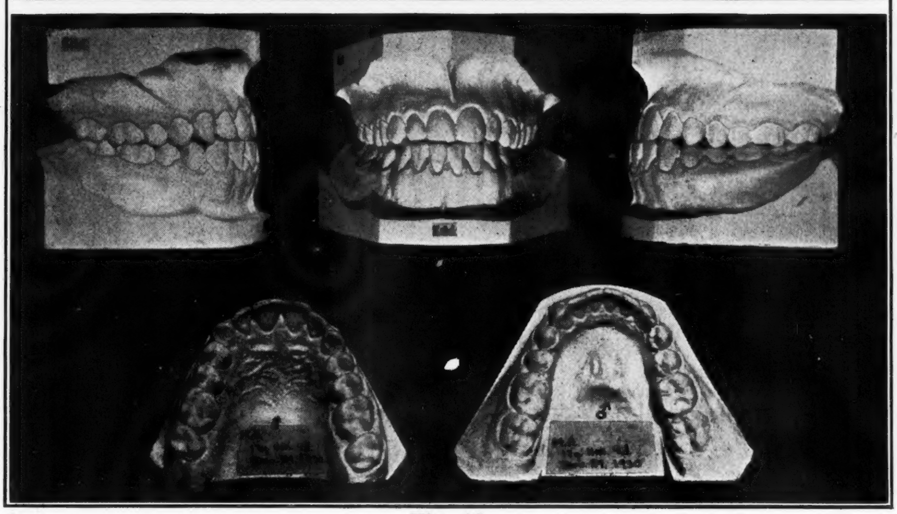


Fig. 13.

Fig. 12.—Casts of same dentition as in Fig. 10, one year after discarding appliances, showing result still in perfect condition.

Fig. 13.—Casts of same dentition as in Fig. 10, four years after discarding appliances, showing relapse on left side.

the patient is the guinea pig, but I am not to be blamed for that. The mother had all the say about it, and I just made the best of my opportunities. It meant much trouble, a great deal of work, the patience of a saint and a good sense of humor to accomplish the task up to the present. The story is of a robust boy ten years of age, whose mother is oversolicitous about his well-being. She thinks he is nervous and is very much concerned about it, but does not realize

Fig. 14.

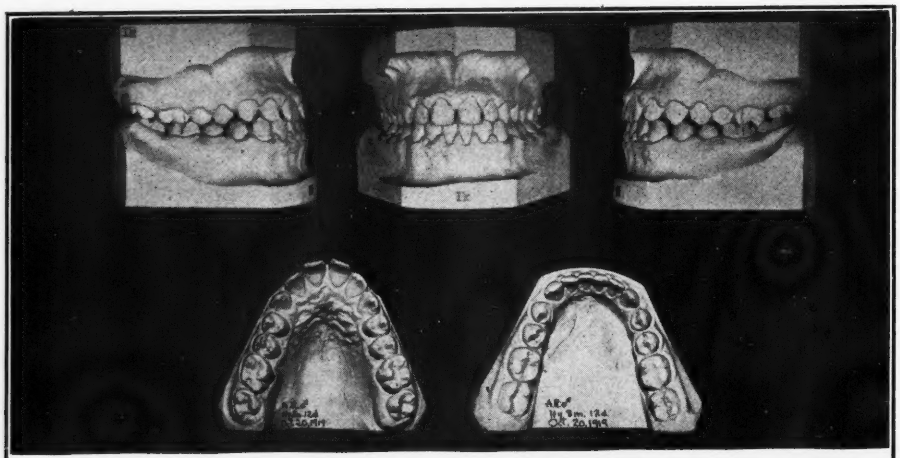


Fig. 15.

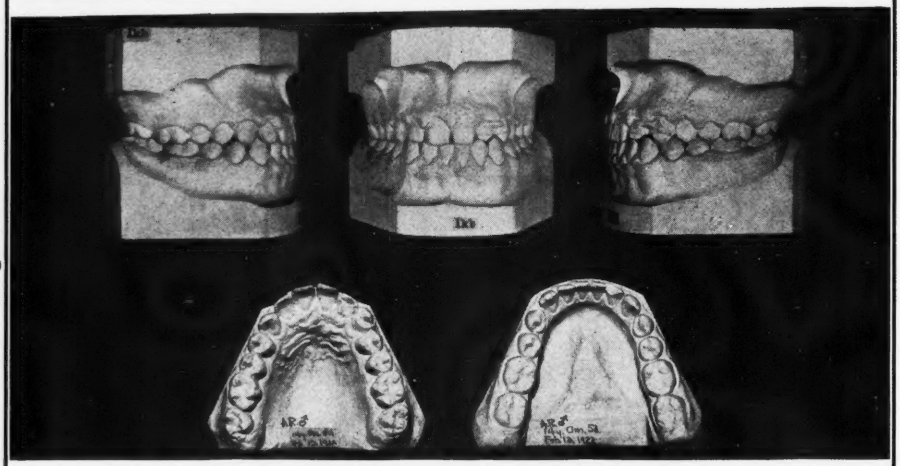


Fig. 16.

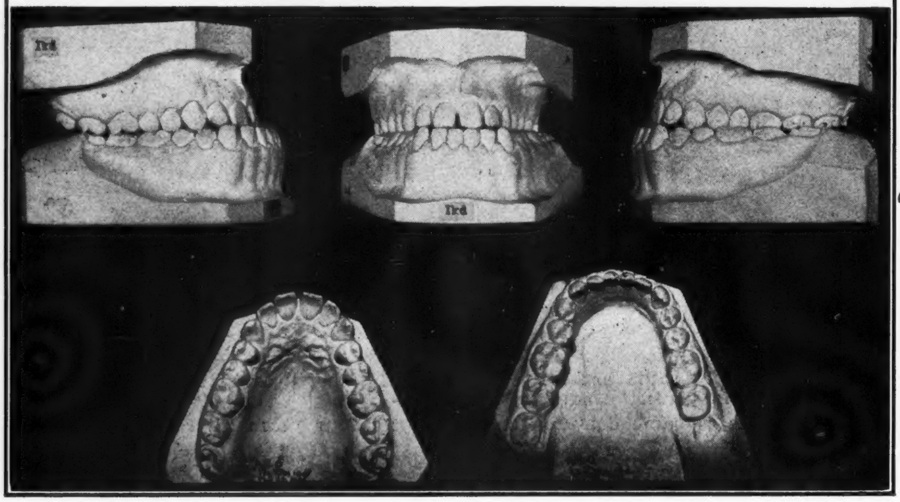


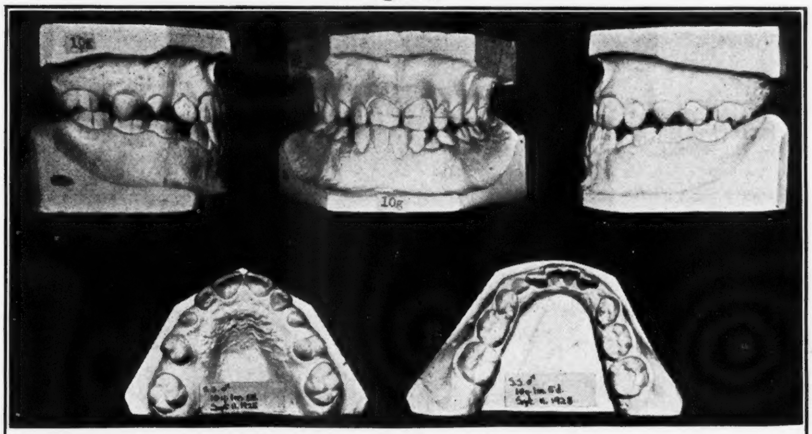
Fig. 14.—Casts of dentition of boy, aged eleven years eight months, showing tendency to Class III malocclusion.

Fig. 15.—Casts of same dentition as in Fig. 14, two years later, showing corrected tendency and normal occlusion.

Fig. 16.—Casts of same dentition as in Fig. 14, five years after treatment, showing development of extreme case of Class III malocclusion.

that she is in part to blame for it. Anyway, it is his dentition which bothers me. This is shown in Fig. 17. There is no doubt about its belonging to the Class III group. But, in addition, the maxillary second premolars, as in the case shown in Fig. 10, were unerupted and the spaces for them partly closed. Of course, treatment was advised but delayed for one year and a half because of the mother's concern about its affecting his health. When he came again, the dentition, as shown in Fig. 18, was considerably changed. He was then eleven and one-

Fig. 17.



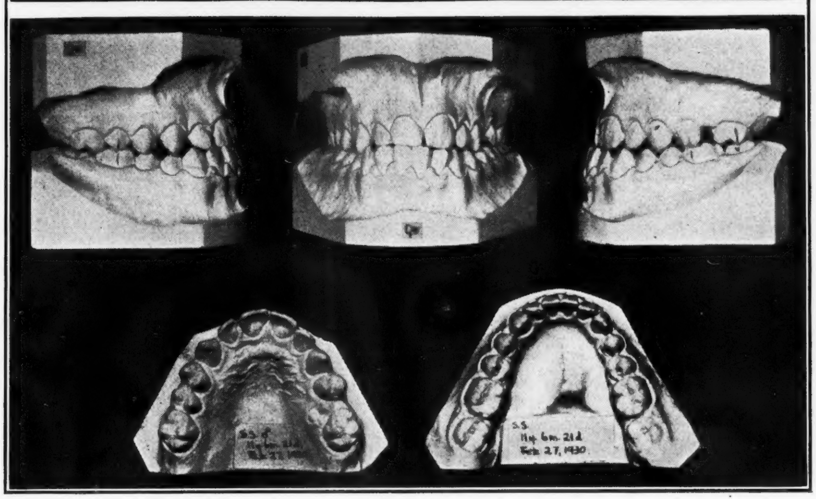


Fig. 18.

Fig. 17.—Casts of dentition of boy, ten years of age, showing complicated case of Class III malocclusion. Treatment was deferred.

Fig. 18.—Casts of same dentition as in Fig. 17, one and one-half years later, showing improvement in alignment of teeth, but malocclusion worse.

half years of age, had all the teeth present except the maxillary second and all the third molars. The malocclusion had gotten much worse, in spite of the fact that all the teeth with the exception of the maxillary left second premolar were in better alignment. It should also be noticed that the maxillary right second premolar took its proper position, in spite of the fact that the space was previously partly closed. On the left side, the space for the second premolar is considerably increased, though not enough to accommodate the tooth which is erupt-

Fig. 19.

Fig. 20.

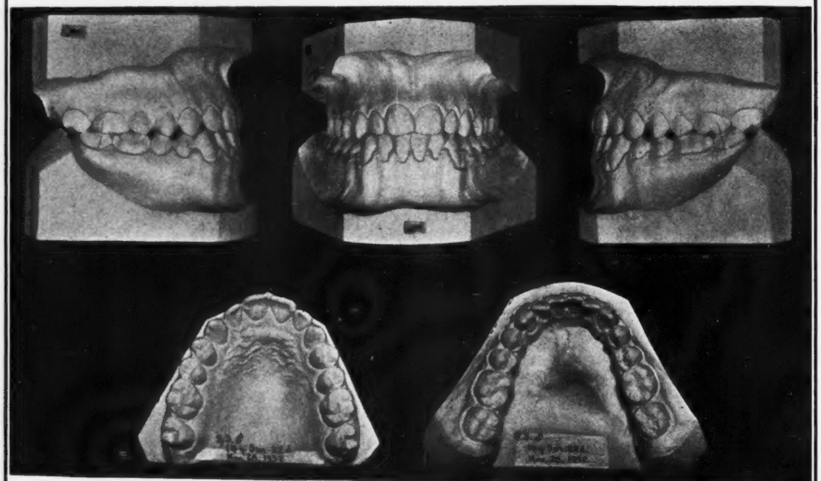


Fig. 21.

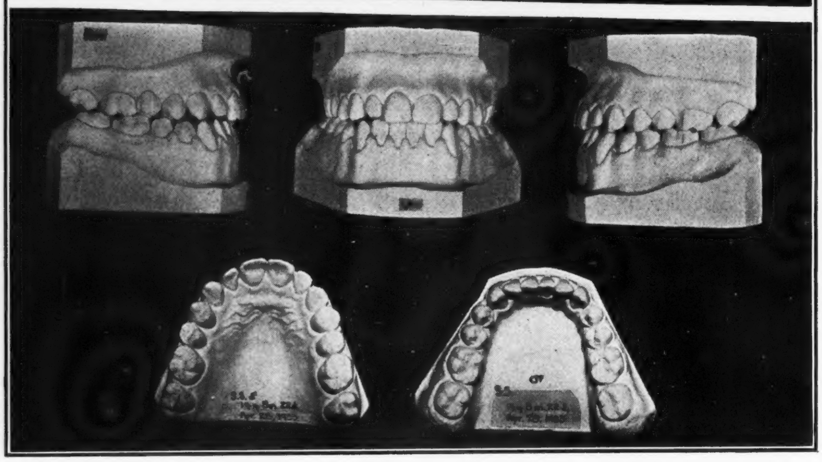


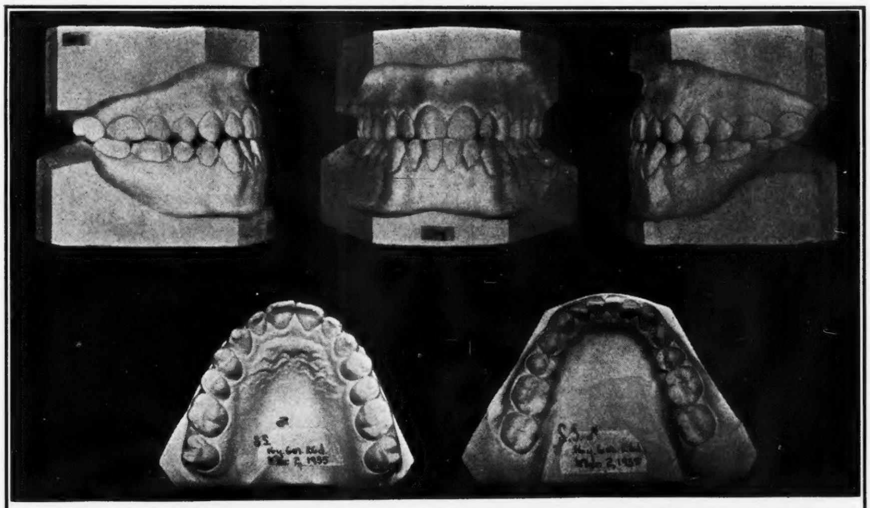
Fig. 19.—Casts of same dentition as in Fig. 17, after one year and four months of treatment, showing excellent result obtained.

Fig. 20.—Casts of same dentition as in Fig. 17, one year and five months after active treatment, showing complete relapse to Class III. For reason given in text no retention was resorted to. Treatment was resumed.

Fig. 21.—Casts of same dentition as in Fig. 17, five months after resumption of treatment, showing elevation and backward tilt of mandibular first molars. For reasons given in text treatment was again discontinued.

ing lingually. The mother was anxious to have me begin the treatment, which was initiated at once. After one year and four months of treatment the space for the maxillary left premolar was opened, the tooth took its proper position and the occlusion was completely corrected. Fig. 19 illustrates the occlusion of the dentition at that time—a perfectly good result. The maxillary left permanent second molar was just coming into place and the right one was still missing.

Fig. 22.



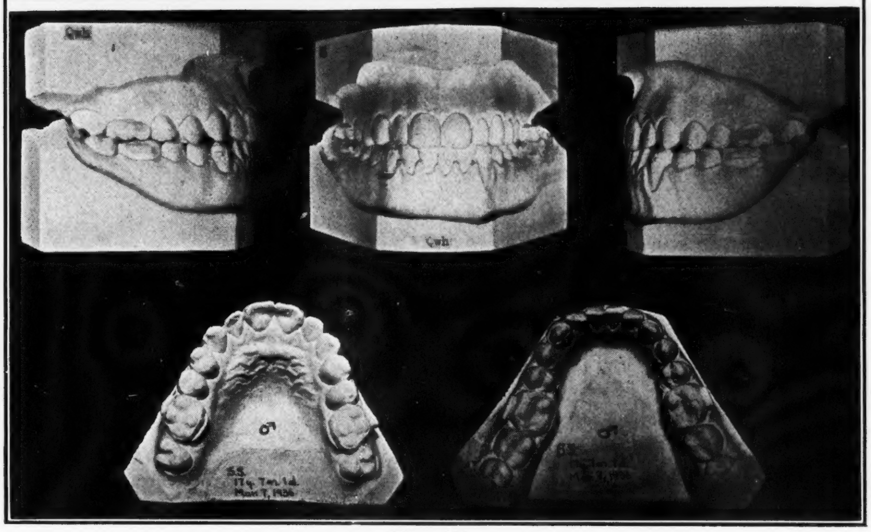


Fig. 23.

Fig. 22.—Casts of same dentition as in Fig. 17, two years after discontinued treatment, showing complete relapse to Class III. Treatment was again resumed.

Fig. 23.—Casts of same dentition as in Fig. 17, one year after again resuming treatment, showing normal occlusion regained. Retention is still continued.

The mother at this point was overanxious for me to stop so as not to overtax the boy. I warned her that she would be responsible for the further outcome of the boy's mouth if no retention was resorted to at this stage. She willingly agreed to that. The mouth looked so wonderfully well and the boy was such a good boy that she could not understand that there would be any risk. So we stopped.

A year and a half later, the boy was brought back. The occlusion, as seen in Fig. 20, is again completely in Class III. Treatment was started again, to end disastrously shortly after. The boy was an athlete and chewed gum. When he was not doing athletics, he consoled himself with caramels. Anyway, neither of those practices was of great help. I am still puzzled how he did it, but in five months the mandibular first molars, as shown in Fig. 21, were so much elevated and tilted backward that I was compelled to remove the appliances and let him go. He had become so unmanageable that no cooperation at all could be expected. I decided to have nothing more to do with this case and dismissed the boy, of course with the parent's consent. The father understood the situation thoroughly. Nearly two years had elapsed when the boy was brought back again. The occlusion, as shown in Fig. 22, was as bad as, if not worse than, it was when I first started. He was then sixteen and a half years old. After much deliberation and warning on my side and promises on the other side, treatment was resumed in March, 1935. Cooperation now is splendid. At this time, just a year later, the dentition, Fig. 23, is again in normal occlusion. Retention is still kept up and will be kept up for some time. The outcome of this case will be reported later. In this case again the difficulty is not with the treatment. The response to the mechanical devices including the intermaxillary elastics is better than could be expected. It is what happens after the machinery stops working that bothers me.

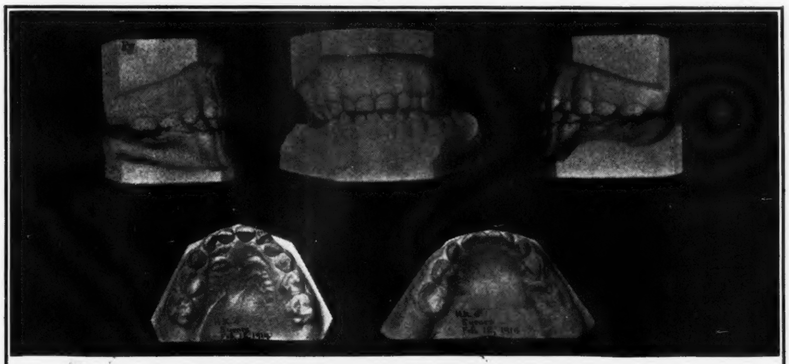
As has been mentioned, the last spurt of growth occurs during the stage of adolescence, and since it is also reasonably clear that adolescence in boys is close to those incidents leading to the beginning of eruption of the third molar teeth, it looks very much as though the tendency to relapse may be more securely kept in check if retention is continued beyond that period, rather than stopped before. This boy is just now passing through this stage of development. Retention is therefore continued.

An interesting peculiarity of Class III is its unexpected appearance. Angle was under the impression that "Deformities in this class begin at about the age of eruption of the first permanent molars or even much earlier, and are always associated at this age with enlarged tonsils and the habit of protruding the mandible, the latter probably affording relief in breathing." Angle thus believes that "these are potent factors in causing the mesial locking of the permanent teeth as they erupt."[1] I am not so sure about the habit and the large tonsils, but Angle is partly correct about the time of appearance of Class III. However, while he suggests the period when the permanent first molars erupt, other periods too may safely be added on. Thus the time when the second and third molars erupt is just as opportune and perhaps more probable for Class III manifestations to appear (or reappear after treatment) as that when the first molar erupts. It should, however, be understood that this is not due to the effect of "erupting" or "locking" of the teeth, but rather, as has been explained, to the physiologic changes which take place in growing up. As it happens, girls mature more closely to the time when the second molars erupt, while boys do the same thing much later, closer to the beginning of eruption time of the third molars. In both instances there is a spurt of growth taking place which affects

the size of the jaw bones, as well as the rest of the body. It is perhaps on account of an overemphasis of these effects that relapses occur. The age when it happened in the cases shown is usually after seventeen. The effect of these physiologic influences may also explain the sudden appearance of Class III malocclusion.

In watching children for lengthy periods of time it is surprising to find that some dentitions previously recorded as normal or as Class I suddenly appear as Class III. From 1920 to 1924 I examined at half-yearly intervals a group of sixty girls. At eleven years of age one among them recorded as normal and one as Class I changed to Class III at thirteen and fourteen respectively. Of

Fig. 24.



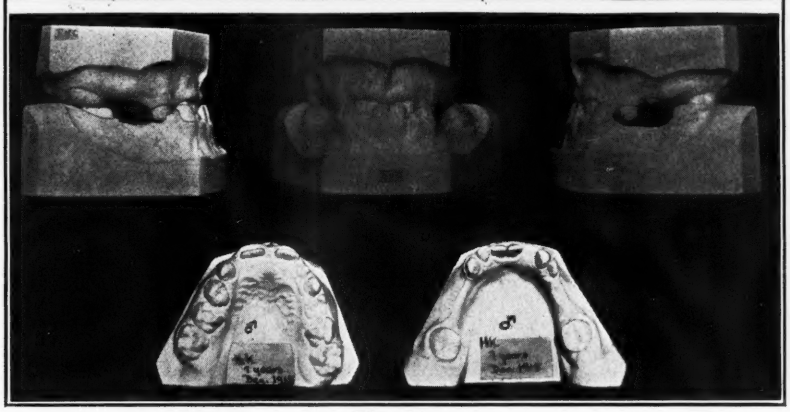


Fig. 25.

Fig 24.—Casts of dentition of boy, five years of age, showing deciduous teeth in normal occlusion. Supernumerary maxillary left lateral incisor.

Fig. 25.—Casts of dentition of same boy as in Fig. 24, two years later, showing complete development of Class III malocclusion.

course, I was suspicious at first that I might have made a mistake, but on resorting to the casts of other cases I am quite sure that such changes really occur. A case of this sort, though considerably younger, is shown in Fig. 24, which presents the deciduous dentition of a boy five years old. Despite the fact that there is a supernumerary maxillary left deciduous lateral incisor, which is no doubt due to aberrant congenital or genetic conditions, the teeth are in normal occlusion. The only defects are the badly decayed deciduous mandibular second molars. This is one of those boys who have a horror of dentists. It took much persuasion to have him come to me. How I obtained the impressions for these

casts is still puzzling me. He did stay away after that for nearly two years. When he came again, I was appalled by the condition of his mouth. As shown in Fig. 25, all the deciduous teeth with the exception of the canines and the maxillary left lateral incisor were lost, although the boy was not quite seven years of age. The maxillary and mandibular central incisors and the mandibular lateral incisors were still erupting, and the four permanent first molars, though fully erupted, had large occlusal fillings. The occlusion was definitely in Class III, in addition to which the maxillary left permanent first molar was in

Fig. 26.

Fig. 27.

Fig. 26.—Casts of dentition of girl, aged five years, showing deciduous teeth in normal occlusion, with deep overbite.

Fig. 27.—Casts of dentition of same girl as in Fig. 26, after ten years of orthodontic treatment, showing tendency toward Class III.

lingual position. This was the last I saw of him. Whether it was due to the impression I took of his teeth or the impression I made on him, I am still wondering. But still more puzzling is the rather rapid change from normal to Class III in such an unexpected way. Of course, due to the sloppy condition of his teeth, the situation is considerably confused. But why did these conditions end in Class III and not in any other class of malocclusion?

A case of this sort is usually given no particular attention. In my estimation it should be looked at with considerable apprehension when treatment is

undertaken. Those who are unaware of such trends and tendencies are liable to make some serious blunders. A good example is the case shown in Fig. 26. Among several Class III cases treated by others which have come under my observation there are some which had been treated without any success and others which became Class III after the prolonged treatment of Class I. The dentition shown in Fig. 26 is that of a girl approximately five years of age. With the exception of an excessive overbite, I fail to see any trouble in this

Fig. 28.

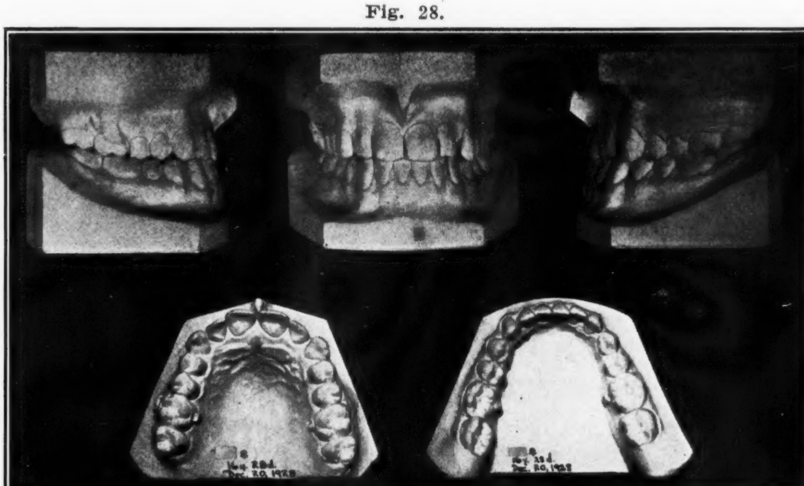


Fig. 29.

Fig. 28.—Casts of same dentition as in Fig. 26, after nine months of further treatment, showing tendency toward Class III made worse.

Fig. 29.—Casts of same dentition as in Fig. 26, after six years of respite from orthodontic treatment, showing improvement in occlusion.

dentition. But this child was not brought to me. She was taken to an orthodontist who believed in early treatment; so he treated her. After ten years of early treatment a creditable result was produced and is shown in Fig. 27. While this result is quite satisfactory, there is a noticeable tendency toward drifting into Class III. The buccal and lingual cusps of the maxillary right molars and

premolars clearly indicate that. Obviously with the intention of heading off any such occurrence the case was treated again. Nine months later the condition shown in Fig. 28 was brought about. What was only a tendency on one side now had become an actual Class III on both sides. Besides that, the maxillary incisors were separated, the canines pushed out of position and the mandibular left permanent first molar was tilted backward and buccally. At this time the case was brought to me in consultation. The patient was sixteen years of age. The dentition was in poor occlusion, and most of the teeth were decayed along the gum margin. It was apparent that she had had enough orthodontia to deserve a breathing spell, so I prescribed a rest without orthodontic devices. Six years later, at twenty-two years, the mouth looked as shown in Fig. 29. The recuperation from the previous orthodontic impact was complete. With the exception of the buccal position of the mandibular left first molar and the lingual occlusion of both maxillary third molars, the dentition is in as good condition as could be expected under the circumstances.

Whether evidence of this sort supports or refutes the argument for early treatment is of little consequence. The point is that it does prove something else. Namely, that Class III is amenable to the procedure entailed in orthodontic treatment, but because of its exact nature, which is not quite clear, we seem to be tampering with conditions we do not understand and achieve results which cannot be maintained. In other words, Class III malocclusion can be successfully corrected by means of orthodontic appliances. But, because of certain inherent conditions prevailing before and after treatment, the appliances, while correcting the occlusion of the teeth, do not overcome the tendency to undo what is so zealously achieved. Moreover, where present, though not apparent, the tendency toward Class III will be realized in the course of development or in the course of treatment. Besides the one shown, there are in my possession several Class III cases which are the results of orthodontic treatment of Class I malocclusion.

Well, then, one might ask, what are those conditions which stand in our way? To this I would answer: they are conditions closely associated with developmental processes. But developmental changes usually favor normal conditions and are always supposed to be helpful in orthodontic treatment. Why should they bother us in the treatment of Class III malocclusion? The trouble is that the changes which bother us in Class III cases are, to be sure, developmental changes but such as have gone wrong.

One hardly realizes the fineness of the boundary line which separates the normal from the abnormal when the intricacy of development is taken into account. The rough idea conveyed by the occlusion of the teeth is no criterion at all to distinguish development so far as the rest of the individual is concerned. It is not occlusion that determines development; it is the other way around. Occlusion may be the last vestige holding the dentition on the normal side when the surrounding parts have already crossed the boundary line. Let us for a moment forget the teeth and look at the jaws and face. We assume, according to certain fashions of diagnosis, that the position of the teeth and the form of

the face are so intimately related to each other that they are indicative of certain universal laws. Whether it is the canine law of Simon[3] or the law of occlusion and facial balance of Angle[1] does not matter. If we examine a large number of human anatomic material of the dead or faces of the living, we are impressed with the rule of variation and not with the exception of uniformity. Such investigations surprise one that Class III is so rare, in view of the fact that there is so little between it and the normal when the face as a whole is taken into account.

Faces with dentitions in normal occlusion do not always follow a uniform type which may be considered as "normal." There are some faces with dentitions in normal occlusion which look more like those with Class III than do those with Class III malocclusion. In Fig. 30 is shown a superposition of facial profile

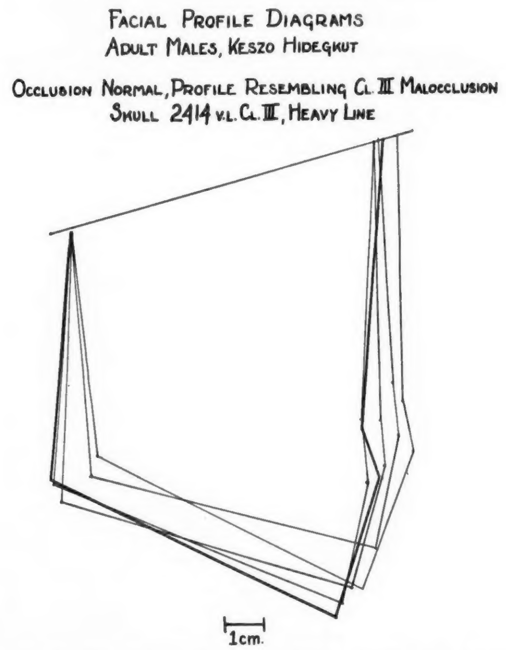


Fig. 30.—Facial profile diagrams of adult male skulls of European Whites, showing resemblance between faces with dentitions in normal occlusion and one (heavy line) with Class III malocclusion.

diagrams constructed from measurements of a large number of skulls of European Whites. The heavy line diagram is of the face of a skull of the same group with Class III malocclusion, while all the other diagrams are of the faces of the skulls with dentitions in normal occlusion. Note the resemblance in the profile of all those faces. These diagrams show that in both instances the faces are much alike, although the occlusion of the teeth is so widely different. In both instances the fact is apparent that the occlusion of the teeth and the form of the face are independent phenomena depending upon other factors to bring them into harmonious relationship. It is very probable that those factors are also concerned in emphasizing differences. Whatever they may be, the effect may be so marked as to create noticeable contrasts between the growth of the face and the development of occlusion of the teeth. In some instances the one

feature is more conspicuous; in others, the other. They may both be affected to the same degree but in opposite ways.

In Class III the emphasis is usually on the positive side in the growth of the jaws and on the negative side in the occlusion of the dentition. These differences are so much more emphasized because of the contrasting effect upon the maxillary and mandibular jaws in Class III cases. In the cases shown these features are quite well illustrated. Other effects of a different nature may be

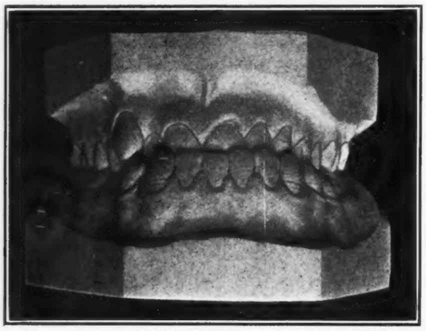


Fig. 31.—Casts of dentition of male with Class III malocclusion, showing peculiar enamel formation in mandibular teeth.

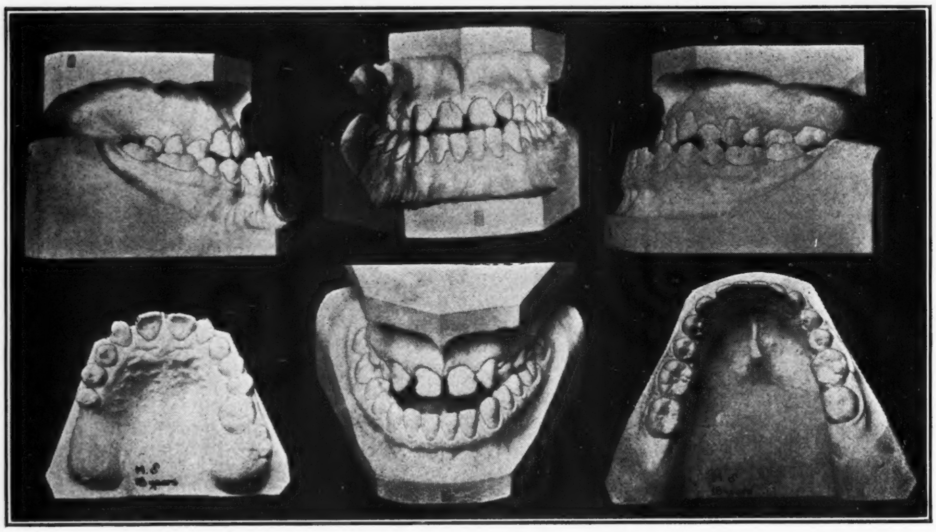


Fig. 32.—Casts of dentition of male, eighteen years of age, showing extreme Class III malocclusion with congenitally missing maxillary lateral incisors, maxillary right first and second molars and all third molars. Presence of maxillary deciduous canine teeth.

seen in certain details of tissue formation. In Fig. 31, for instance, is shown a Class III case in which the enamel is formed in horizontal ridges looking like ripples on the mandibular canines, indicating certain irregularities in the enamel formation. In more exaggerated Class III cases certain disturbances of the teeth appear which affect the tooth germs, causing the disappearance or non-appearance of certain teeth. Thus in Fig. 32 is shown an extreme case of this kind. This is shown in the front view by the tremendous gap between the maxillary and mandibular front teeth, and in the side views by the occlusion

of the maxillary first premolar with the mandibular first molar. The occlusal view of the palate and maxillary dental arch demonstrates the further abnormality of this case. Thus the maxillary lateral incisors are congenitally missing, the permanent canines have erupted in their place, and the deciduous canines occupy the position of the permanent canines. On the left side the maxillary third molar and on the right side all three molars are congenitally missing.

The extreme to which conditions of this sort may give rise is shown in Fig. 33. So far as malocclusions go, I can see no serious objection why dentitions of this sort cannot be classified according to the occlusion of what there is of it. From all indications the occlusion of the teeth present and the relationship of the alveolar arches are such as to fit it well among those belonging to Class III. The characteristic features are not different, but extremely exagger-

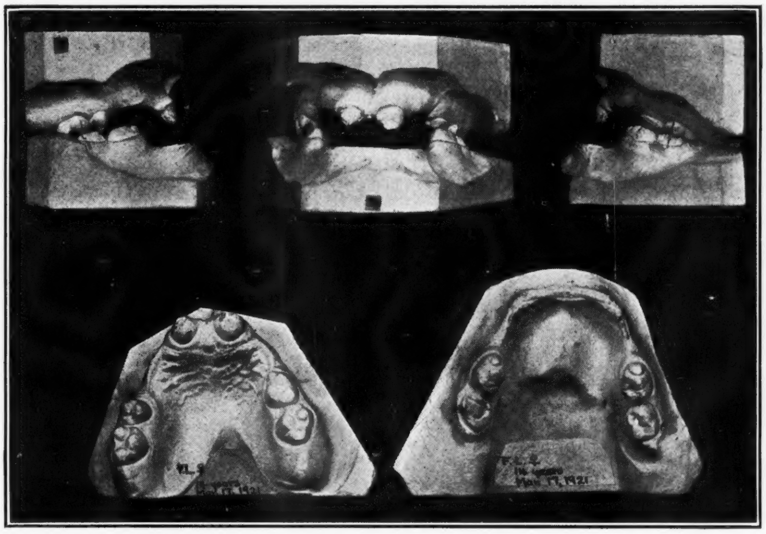


Fig. 33.—Casts of dentition of girl, fourteen years of age, showing Class III malocclusion with congenitally missing maxillary lateral incisors, canines, premolars, and third molars; mandibular central and lateral incisors, canines, premolars and third molars. All teeth present are abnormal in form.

ated. The teeth are more suppressed in development, and those present are abnormal in form. The jaws and alveolar processes, on the other hand, are fully grown.

If we are to follow the manifestation of Class III malocclusion to the end, we should also include those extremes beyond which it is not possible to reach. The one extreme is at the beginning of individual development representing those aberrations which have gone wrong at the start. This will illustrate a manifestation which shows detrimental effects not only upon the teeth before they are formed, but also upon the bony scaffolding which is to hold them in place. The other is at the end of individual development representing those aberrations which go wrong after an orderly succession of events until the completion of development. This will illustrate a manifestation which shows exaggerated effects upon the mandible and other bodily structures. In both instances the relationship of the maxillary and the mandibular teeth is in Class

III malocclusion. The first extreme is represented by those cases known as cleft palate. In Fig. 34 are shown the casts of the dentition of a boy twelve years of age. The maxillary dental and alveolar arches, as well as the palate, are entirely deformed. The mandibular dental and alveolar arches, on the contrary, are rather well formed. With the exception of the slight crowding of the incisors and displacement of the mandibular right first premolar, the teeth are in fairly good alignment. The occlusion, as seen in the side view of this

Fig. 34.

Fig. 35.

Fig. 34.—Casts of dentition of boy twelve years of age with cleft palate and harelip, showing Class III malocclusion.

Fig. 35.—Casts of same dentition as in Fig. 34, seven and one-half years later, showing result of treatment.

figure, is in Class III. Due to the extreme deformity of the palate, the maxillary dental arch, as seen in the front view, is so constricted that the maxillary teeth with the exception of the left first premolar are in lingual relationship to the mandibular.

Even in such hopeless deformities orthodontic procedures may be of help. It took seven years of patient, persistent and persevering effort to do something

for this boy. The result was quite favorable. In Fig. 35 is shown the dentition after the completion of the treatment. The teeth were satisfactorily aligned, the dental arches assumed a natural and symmetrical form and the occlusion was quite satisfactory. The trouble was that the tissues worked upon were not entirely adequate. All the third and the maxillary right second molars were congenitally missing. There was also a defective alveolar bone structure. When the treatment was completed, there was considerable alveolar bone resorption. As seen in Fig. 35, the gum of the maxillary and mandibular incisors and canines is considerably receded. At this stage the young man was given and instructed to wear a maxillary vulcanite plate to prevent any tendency toward collapse of the dental arch. Of course, he discarded it too soon. Seven years later the inevitable happened, and the dentition, as shown in Fig. 36, is not as it was before. The maxillary arch did collapse, but the rest of it looks better than might be expected.

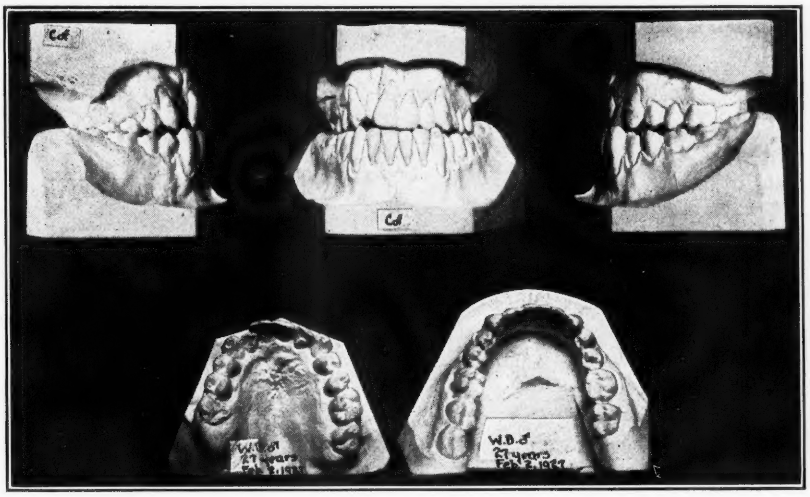


Fig. 36.—Casts of same dentition as in Fig. 34, seven years later, showing relapse.

The other extreme is represented by those cases known as acromegaly. In this type there are those unfortunate conditions which are brought about by a flare-up of late growth affecting, among other parts, the size of the mandible. The occlusion, as shown in Fig. 37, representing the dentition of a man thirty-seven years of age, is in Class III malocclusion. In contradistinction to the other case, the maxillary alveolar and dental arches remained apparently unaffected, while the mandibular became enlarged. This is shown by the tremendous spread in width of the mandibular dental and alveolar arches, the spacing of the teeth, as well as by the occlusion, the mandibular teeth being in buccal relation to the maxillary. Owing to the cause of these conditions, it is questionable whether orthodontic procedure is indicated and whether it would be of help if carried out. Another case of this sort which had a fatal end was reported in a paper in 1914.[6]

The point of interest in these contrasting cases is that, while illustrating extraordinary extremes, they also indicate the range of forms which Class III

cases of malocclusion may assume, and the spread of time when they may occur. However, taking into account the fundamental nature of the causes which bring them about, it is apparent that manifestations of this sort are not much different from those which are the outcome of the normal processes of life in general. But, because of certain aberrations in coordination, harmonious integration is disturbed and chaos is rampant. In the case of cleft palate, the trouble is due to disturbances of congenital or perhaps genetic origin, and in the case of acromegaly to disturbances of endocrine imbalance brought about by overactivity of the pituitary gland. To be sure, Class III malocclusion does not clearly belong to either of these abnormalities, but when carefully analyzed there are to be found some of the earmarks which suggest relationships to such disturbances as are brought about either by congenital or genetic influences, by hormonic imbalance, or by both. It should, however, not be imagined that dis-

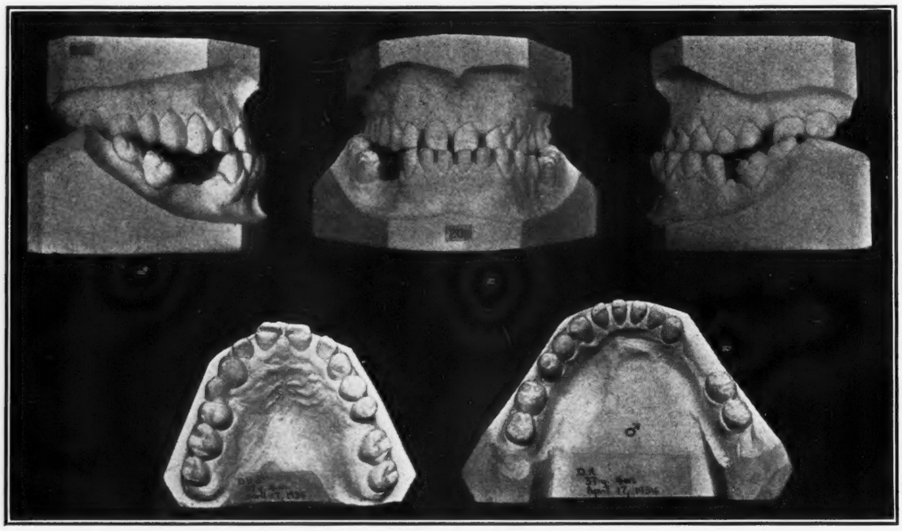


Fig. 37.—Casts of dentition of male with acromegaly, showing extreme Class III malocclusion and tremendous spread of mandibular alveolar and dental arches.

turbances of this sort are of recent origin and that civilization is to be blamed for it. Already in the Stone Age man is known to have had Class III malocclusion, as shown in Fig. 38.[7] Class III malocclusion is, however, also found in other mammals. As a classical example, the bulldog is usually referred to. But, due to the fact that there is a good deal of artificial tinkering connected with the production of this deformity in bulldogs, it is questionable whether the effect is entirely due to natural causes.

In the anthropoid apes, however, Class III when present is also associated with the same concomitant defects and deficiencies as in the dentition of man. Thus in chimpanzee, Fig. 39, as shown in the occlusal view, the mandibular dental arch is normal so far as its form and number of teeth are concerned. In the maxillary the second premolars and third molars are congenitally missing and the right deciduous molar is still present. As shown in the side views of Fig. 39, the relationship of the teeth is as characteristic as it is in the human

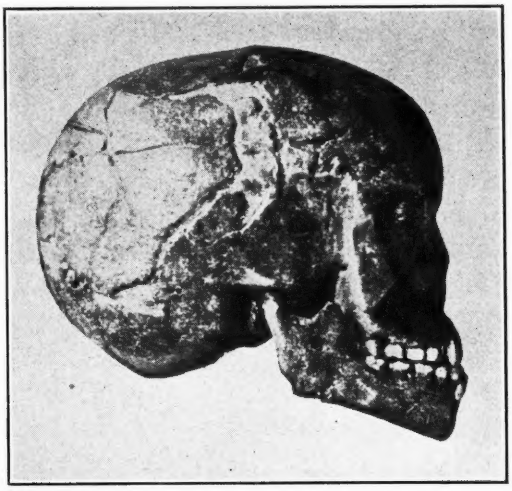


Fig. 38.—Skull of prehistoric infant, showing Class III malocclusion.

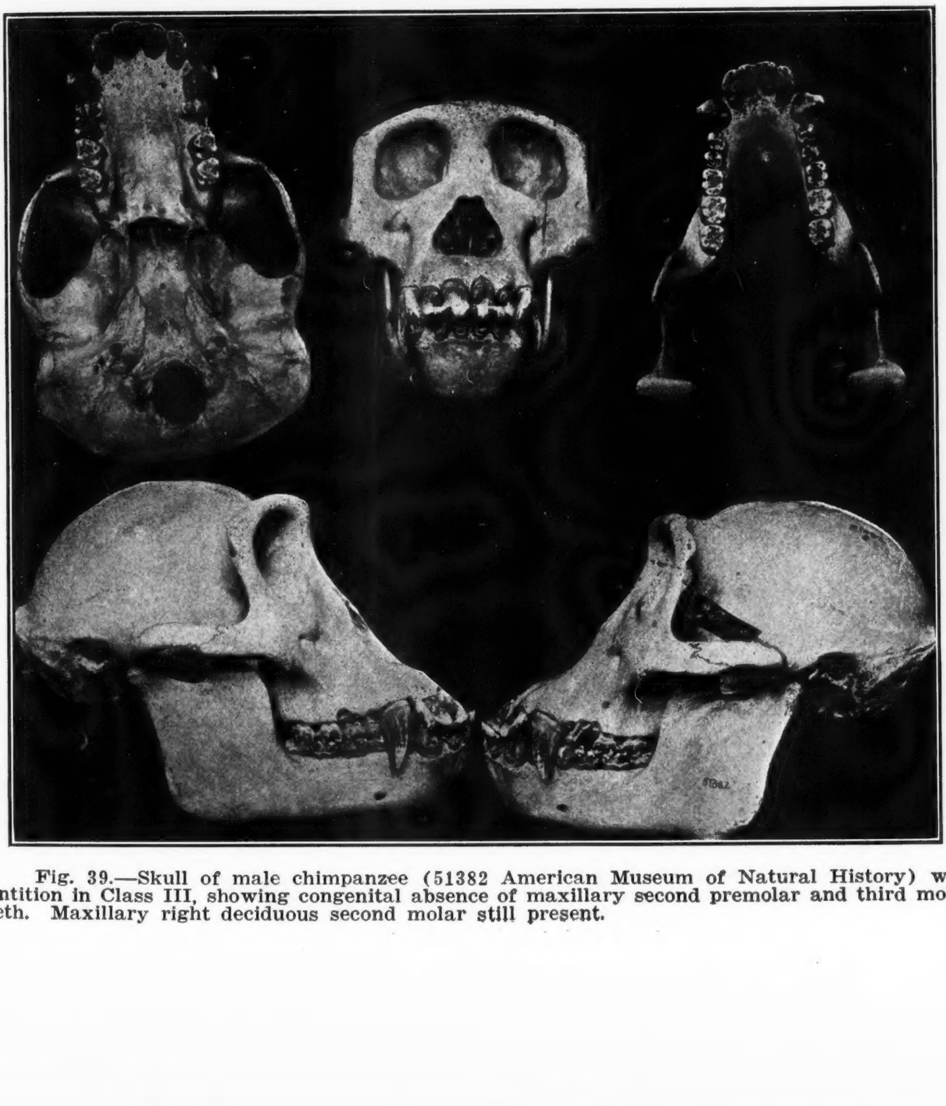


Fig. 39.—Skull of male chimpanzee (51382 American Museum of Natural History) with dentition in Class III, showing congenital absence of maxillary second premolar and third molar teeth. Maxillary right deciduous second molar still present.

dentition with Class III malocclusion. Evidence of this sort points to the fact that the problem involved is far more profound than is indicated just by the occlusion of the teeth.

Though in the present contribution the approach to the problem was made by way of the dentition and its occlusion, it is intended in a subsequent report to take into account the face from the viewpoint of development as it affects the changes of the jaws in this type of malocclusion. From evidence already at hand, it is becoming apparent that the time when Class III most often appears is also the time when significant physiologic changes take place, stimulating growth. The face and jaws are conspicuously involved in that. It is therefore quite possible that those factors which promote and control normal growth when gone wrong are also involved in bringing about abnormal manifestations such as Class III.

SUMMARY

To summarize the points of particular significance, it may be said that:

1. Class III is one of those disturbances of the dentition which represents the magnitude and complexity of the entire problem of malocclusion.

2. Although the nature of it is insufficiently understood, Class III is very amenable to the mechanical procedure used in orthodontic practice.

3. Due to the intricate nature of its manifestation, the gratifying results obtained in the treatment of Class III are subject to relapse long after the completion of treatment. The earlier the treatment is completed, the more severe the relapse.

4. Due to certain peculiarities of development, Class III has been observed to arise in the course of growing up. Dentitions in normal occlusion or in Class I malocclusion have in the course of development been observed to change to Class III.

5. Due to lack of recognition of these peculiarities, the treatment of certain Class I cases actually ends in Class III.

6. Studies of deficiencies and defects in teeth associated with Class III malocclusion warrant the assumption that congenital disturbances and endocrine imbalance may be involved in the etiologic complex.

7. Studies in development of the face to be reported later on indicate that disturbances in those factors which promote and control growth and differentiation may produce abnormalities of various kinds. Examples of it are: (1) cleft palate with its accompanying tooth and associated tissue deficiencies in conjunction with the occlusal disturbances at one extreme; and (2) acromegaly with the enlargement of the mandible, tongue, etc., at the other.

8. Though Class III belongs to neither of these extremes, the variety of forms in which it appears may well occupy positions somewhere within the extensive stretch between cleft palate and acromegaly.

9. It is thus becoming increasingly clear that by determining the nature of its manifestation it may be possible to ascertain more accurately when and how it comes about, and the reasons for the tendency to relapse.

10. The lasting results of successful therapeutic measures thus depend upon more exact knowledge to be gained by further studies of other well-recorded cases. Material for such studies is already available, and the result of further investigation will be reported as time and opportunity will permit and the needs of the profession will demand.

REFERENCES

1. Angle, Edward H.: Malocclusion of the Teeth, Philadelphia, 1907, S. S. White Co.
2. Lischer, B. E.: Principles and Methods of Orthodontics, Philadelphia, 1912.
3. Simon, Paul: Fundamental Principles of a Systematic Diagnosis of Dental Anomalies, translated by B. E. Lischer, Boston, 1926, Stratford Company.
4. McCoy, James D.: Applied Orthodontia, Philadelphia, 1931, Lea & Febiger.
5. Hellman, Milo: An Interpretation of Angle's Classification of Malocclusion of the Teeth, Supported by Evidence From Comparative Anatomy and Evolution, Dental Cosmos, April, 1920.
6. Hellman, Milo: A Study of Some Etiological Factors of Malocclusion, Dental Cosmos, September, 1914.
7. Gaillard, C., Pissot, J., and Cote, C.: L'Abri Prehistorique de la Genière a Serrières-sur-ain, L'Anthropologie, Fig. 7, Vol. 37: 1927.

DISCUSSION

Dr. G. W. Grieve, Toronto, Ont.—Dr. Hellman has presented something to us that is very important, and has discussed a type of case with which we are all familiar, but, thank God, one which we are not so often called upon to treat as the other types. All of us, I think, find fewer of them, for which we must be thankful.

I am sorry Dr. Hellman did not say something about the tongue in connection with this type of case. He rarely speaks of local factors; he is entirely a biologist. When you question him about local factors, he says, "I don't know," but we must consider those factors.

I have no doubt at all but that the tongue is the biggest local factor in these cases, and Miss Ramsey brought that out quite clearly in her discussion of correcting speech defects. She spoke particularly of the tongue in some of the cases of this type.

Dr. Blair and Dr. Federspiel have both done operations for removal of certain portions of the tongue. As Dr. Blair describes it (I talked with him many years ago concerning it), he takes a piece of apple pie out of the center of the tongue. Dr. Federspiel has done that operation in three or four instances, taking a piece out of the tongue to decrease its size. The shape of the piece would be governed according to whether you wanted to narrow the tongue, shorten it, or a combination of both.

There are, perhaps, endocrine disturbances, concerning which we know very little, which possibly bring about this condition. I have been very anxious in some of my cases of this type to have this operation performed. Dr. Blair, many years ago, and Dr. Federspiel about that period, and also last night, said there is no danger at all in doing this operation, and you get perfect articulation in speech after it has been done. Oral surgeons know, from operations which have been done upon tongues, where there has been cancer and that sort of thing, and quite large portions of the tongue have been removed, that articulation is good. I hope that the surgical treatment of these cases will come into more general practice, and thus correct what seems to be the prime causal factor—the increased size of the tongue. Parents hesitate to consider anything of this nature; it seems a very radical thing. We have the assurance of these men, who have had a large experience, that there is no danger in doing this operation. I have discussed the matter with Dr. Risdon, quite a prominent oral surgeon in Toronto, who had a great deal of experience during the war, and since, in oral surgery and plastic surgery of the face, and he also assures me that there is no danger at all in doing an operation of this kind; yet I have not been able to get him to the point where he would, in the presence of parents, enthuse about the idea of doing it. He takes the ground that it is rather an unusual thing to do, and he wants to have the parents take all responsibility in regard to the matter. Still these men all say there is no danger in doing this.

I believe the tongue is a big factor, and, if we can reduce its size, I think the relapses which Dr. Hellman has shown us, and which take place so constantly, can certainly be gotten rid of.

Again, I believe that in these cases we have a forward displacement of the mandibular teeth, and in cases of double protrusion this forward displacement in both maxillary and mandibular teeth, and sometimes spacing, as Dr. Hellman has shown. In these cases in which the tongue is large, and you get the teeth back into place, they are not going to stay there. You have to put in some form of retaining appliance in order to prevent the relapse which is bound to take place. If we can correct the real cause, there will be no more difficulty with these than with any other cases. Of course, those patients with acromegaly are beyond our possibilities.

We owe Dr. Hellman a debt of gratitude for this presentation.

TRENDS IN ORTHODONTIA

Harry E. Kelsey, D.D.S., F.A.C.D., Baltimore, Md.

In THE last thirty-five years during which orthodontia has existed as a specialty, I think it may truly be said that its practitioners as a whole have devoted themselves whole-heartedly toward its advancement along lines which would develop its effectiveness in securing results in treatment. So intense has been the search for knowledge and information which would prove beneficial and enhance our chances of success in treatment that almost every field of science, art, and mechanics has been invaded with results that, taken as a whole, may be regarded with much satisfaction.

In the technical aspects of our work, great improvement has been made in the materials we use. Often the improvement has been gained only after long and sometimes bitter controversy, as in the case of base metals versus noble metals for the construction of appliances. After the general superiority of the noble metals had been demonstrated to the satisfaction of at least a majority of practitioners, it remained to develop their useful inherent qualities to a still higher degree. To this end many men devoted long and intensive research; and, in addition, the manufacturers, who were of course eager to supply a material which would be serviceable and therefore popular with their patrons, devoted much time and money to the same object and in general showed themselves quite willing to develop materials in accordance with suggestions from men whose research and wide experience gave assurance that their opinions would prove of value. Competition among them also lent added impetus to their efforts so that finally as a result of cooperation between the orthodontist and the manufacturer, a very high grade of materials was produced. It was, however, still difficult to secure uniformity of quality in them, and a great step forward was made when the Research Commission of the American Dental Association, through its associates at the National Bureau of Standards in Washington, undertook an investigation of the qualities desirable in wrought gold alloys (for orthodontic purposes). After determining what those qualities were through a questionnaire sent out to the profession, they tested all available alloys, and from those most nearly filling the requirements, specifications were set up which now enable any manufacturer to produce an article which will comply with them. We can therefore secure materials which can be depended upon to act uniformly and efficiently when, in the form of appliances, they are used in the treatment of cases. Further improvement in the technical field has been brought about through the uniform manufacture of various tubes, arches, and attachments of a high quality among which it is possible to select units for the construction of appliances; thus greatly reducing the laboratory requirements for appliance construction.

Read before the New York Society of Orthodontists, New York, Nov. 23 and 24, 1936.

Whether the extensive experimentation and research which have been carried on for some time in the use of chrome alloys as a substitute for the noble metals will result in adaptations of this material which will make it equal or superior to them in usefulness, cannot be stated at this time, but it is another good illustration of the zeal with which orthodontists pursue their search for the ideal.

Quite as important as the improvement in materials was the need for improvement in appliance design, and many of the brightest minds in the profession were devoting themselves to this, the object being to develop appliances which would deliver an artificial stimulus to the tissues through attachments to the teeth or through pressure upon the teeth which would not only be tolerated by the tissues, but also stimulate the desired changes in them. Many and varied were the appliances evolved. Most of them, or at least many of them, have merit, some very great merit. Most of them when thoroughly understood and operated by one who has had experience in the movement of teeth, will get results. Different men, if capable orthodontists, get good results in similar cases with appliances which are notably dissimilar in appearance and design. An analysis of all appliances, simple or complex, will show that they are based upon fundamental principles, which cannot be ignored, and that none of them can be truly effective, and all may be dangerous, in the hands of one who has not mastered the principles which underly their use.

Coincident with this study and investigation in the field of materials and appliances has been the more baffling and probably more important research in the sciences with the hope of securing information which would enable us to evolve a practical etiology which might intelligently guide us in diagnosing our cases, and of course, in their treatment. It is a large field and one in which only a trained investigator may hope to accomplish anything. Speculation will never solve our problems, although it has often been indulged in and experimentally applied. Out of a hundred guesses, one may be right; but, if by good luck we adopt that one and success attends our efforts, we are as much in the dark as ever, not knowing why we were right. We know that a certain given treatment succeeds in many cases belonging to a definite class of malocclusion, but in other similar cases in which it does not succeed, we are not yet prepared to give full and sufficient reasons for the failure. If we had reached that point, we would of course have been able to adopt at the outset the more rational treatment. Nevertheless, thanks to the tireless efforts of many able men with a natural gift for research, which has been fostered by study and adequate preparation, much has been accomplished, and I do not believe that any one will contradict the statement that we are better equipped to attack the problems of malocclusion than were the pioneers of several decades ago. The men who have been carrying on research in the field of growth and development in the human body, and especially in our own particular field, refuse to be beaten and are being joined by an increasing number of recruits from among the younger men who can now more readily acquire the necessary background and preparation for scientific research, and I believe the time will come when orthodontists will be able to distinguish

between those cases which are capable of being successfully treated along ideal lines, and those which through heredity or environmental conditions do not offer the same possibilities.

When compared to previous conditions, the last thirty years show much progress, but we have still a long way to go and the next two or three decades will provide a fertile field for those workers who join the ranks of those already noted for their accomplishment or who take the places of some of them who will naturally drop out.

I have written the foregoing with the idea of showing that orthodontists, as a whole, are enormously interested in their work and eager to increase their knowledge, thereby improving their chances to give a better service to their patients. Our professional organizations, also, continue to thrive and grow. The programs are interesting and instructive, and we are refreshed by a sense of progress and advancement in our work.

But are we taking account of the trend in orthodontic practice and development outside of our own familiar and well-known professional environment, and (I might add) sometimes within it? I might answer my own question by saying that we have sometimes noted and endeavored to correct, and, too, with some success, certain abuses which if not checked would certainly have a degenerating influence upon orthodontia as a specialty, particularly in the eyes of the laity and kindred professions. For example, we have been fairly alert in trying to suppress misleading advertisements by those who are unqualified to give the service which they promise. I refer to those laboratories and technicians who have thriven upon the patronage accorded them by members of the profession and after becoming prosperous through doing that part of our work which they were qualified to do, they have in many instances conceived the idea that the whole of orthodontia lay in the construction of appliances. Having made a great many under the direction of well-known orthodontists for the various types of malocclusion, they have felt that they could not only make but also sell these appliances to dentists who had the legal right to practice orthodontia but actually did not have sufficient knowledge of it to construct their appliances, to say nothing of properly inserting them in the mouth and adjusting them during treatment, or what is of still greater importance, to analyze and diagnose their cases intelligently. Fortunately, through the representations of organized orthodontia, there are fewer of these advertisements appearing in the journals at present. It is unquestionably the duty of the profession to regulate matters of this kind. The laboratory is to be looked upon more in the nature of a business; and we, not they, should be blamed if business ethics are permitted to supplant professional ethics in our specialty.

Again, are we awake to the much more insidious and harmful activities of some within the profession who are willing to prostitute their trust for the sake of added gain? There can be no question but that the depression brought about considerable confusion in the orderly working of the professions and their specialties. The general practitioner felt that he was justified in adding to his income some of the fabulous orthodontic fees which he had heard were

received by the specialists. The orthodontist, in some instances also, feeling the pinch in his finances, succumbed to the urge to increase his income by returning to general practice in which he himself knew he could not be proficient, as in most instances he had not engaged in it for many years. In both cases the fabulous fees were usually not forthcoming. It was rather a case of cutting fees, and, while this might have been an advantage to the laity had they received superior service, it was anything but that, in that they were given a self-advertised service far from what it should have been.

It is quite possible that some of the men who were thus forced, or felt that they were forced, to resume a type of practice long discontinued, believed at the outset that they were justified in their action because they thought they could actually give a service which was at least as good as they formerly gave; but it is quite likely that in most cases they were actuated less by a desire to give a superior service in a new field than to exploit a new field, which they had a legal right to invade, in order to augment their incomes. The results of their adventures have been not unlike previous similar excursions into unfamiliar fields. The orthodontist found that he must supply himself with much new and untried equipment with which to perform unfamiliar operations, and, what was worse, from his standpoint at least, patients were not always available for those unfamiliar operations, something he should have realized before he tried the experiment. The general practitioner, who was in a slightly better position to inveigle some of his patrons into trusting their children in his hands for orthodontic treatment, may have experienced at the outset a slight enhancement of his income, but eventually his experience was that which has characterized similar experiments over a period of the last thirty years, during which orthodontia has developed as a specialty; namely, that for a short time he found he could have appliances constructed and, in one way or another, insert them into the mouths of his patients; but, when it came to treatment, from one to three years was usually sufficient to convince him that he was only making trouble for himself. While a few of these men may have given sufficient study and thought to their cases to get something in the way of results at the outset, most of them later found themselves with a dozen or so cases which would not progress and often were getting worse. In many instances they went to laboratories and had appliances constructed upon models of cases and then placed them in the mouth with the hope that something would happen. In one such instance that I have recently heard of, a dentist said that he had placed the most modern and up-to-date appliance which the laboratory could devise and construct, in the mouth of a patient, who wore it a year, and so far as he could judge no change had been brought about. The case, he thought, was just as it had been when he inserted the appliance. Such an admission seems incredible on the part of a man who is, or should be, familiar with the structures of the mouth, and to some extent at least with the laws of mechanics. It is probable, however, that he did less harm than others who at least knew that manipulation and adjustment of appliances were a part of orthodontic procedure, and in the end left some of their patients worse off possibly than when they started. A review of the

orthodontic literature of the past hundred years will show that the majority of dentists did not undertake the treatment of malocclusion, except by the liberal extraction of teeth, and that only a few in the early days who gave close and conscientious study to the subject achieved any success that was worth mentioning. At the end of thirty years of specialization in orthodontia, it would seem almost as foolish for the general practitioner, without due preparation, to attempt to do orthodontia as for the general practitioner of medicine to invade the field of general dentistry and attempt to put in fillings and perform other operations which he really understands but little better than the patient.

It is quite likely that some, at least, of the general practitioners who invade a special and unfamiliar field of practice do so because of their total ignorance of its requirements; and it is not unusual for such men, after the experiment has been carried on for two or three years, to seek some specialist and ask him to take over the whole lot, asserting that their whole desire is to get out of it and never take another orthodontic case. Thus the orthodontist as well as they and their patients suffers for their misled enthusiasm or, perhaps in some instances, their greed. In all professions there are those who are actuated almost solely by the commercial aspect of their calling; this being the case, it is not surprising to find among the ranks of general practitioners those who advertise themselves as specialists in no less than six or eight different branches of dentistry. Unfortunately it is equally true that among specialists there are some whose motives appear to be just as questionable.

As the laity has become more aware of the advantages of good orthodontic service, the demand for it has naturally increased, and those who would take advantage of this demand have not been slow to see the possibilities it offers. There have been some who have sought to establish themselves, and in some instances have succeeded quite notably, as consultants, who would design appliances for the general practitioner and advise him with regard to the conduct of orthodontic cases which he might undertake. In some instances, it has been adopted as a means for exploiting a special type of appliance which may or may not be patented, but which is usually manufactured and advertised as ready to be placed in the mouth with little or no alteration. As I stated earlier in this paper, most of these appliances in the hands of a skillful and experienced orthodontist may be used to secure excellent results, but neither the appliance itself nor the fancy package in which it is put up will enable one without experience to treat cases of orthodontia successfully. I cannot forget a case that presented for treatment many years ago. The patient was about sixteen years of age and had already been under treatment for a typical Class 2 Division 1 malocclusion for several years. She had in her mouth a labial arch with anchor bands upon the first maxillary molars and stated that this was the only appliance that she had ever had. This arch and the anchor bands had been purchased at the supply house and placed in her mouth by a dentist, who, no doubt believing it to be precisely the same as similar appliances he had seen in the mouths of some of his patients who were at the same time receiving treatment from an orthodontist, thought he should

obtain the same results as they. He knew that orthodontists did correct such cases, but he was too little acquainted with the requirements of treatment to know that he was attempting to do something which was impossible. Evidently he thought that in some vague mysterious way this labial arch wire upon the maxillary teeth would retract them and correct the very obvious protrusion. Having bought the appliance at a first class supply house, he apparently had no doubt but that it would fulfill its advertised possibilities. Of course, one could no more correct such a case with only a simple labial arch on the maxillary teeth than he could pull himself off the ground by his own bootstraps. I might add that this case yielded readily to correct treatment. If, then, dentists can so deceive themselves, it is not strange that they may be even more readily deceived by orthodontists who are willing to encourage them to undertake cases which they cannot possibly carry on to a successful conclusion by themselves and delude them into the belief that with the occasional aid of an orthodontist they may do so. It would be bad enough if they were the only sufferers, but they are not. The patients themselves are probably the worst sufferers both through the loss of time, and in some cases through the production of a condition which may be worse than the original one.

During the twenty-seven years I have been in the exclusive practice of orthodontia I have had four assistants, and it has been my experience, which I believe does not differ from that of other orthodontists, that it is at least a year before they can be relied upon to give any real assistance in the conduct of cases, and for two or three years thereafter a close supervision is advisable. If these men (all graduate dentists, of course, and devoting all their time to orthodontia) cannot successfully conduct cases until they have had from one to three years of special training, how shall we expect a general practitioner, even though an experienced man in his own field, to plunge successfully into the treatment of orthodontic cases under the occasional direction of a competent orthodontist; and, if this be true, how much less likely are they to give competent service under the advice and direction of the laboratory which constructs their appliances? In spite of all that I have said, however, I do not wish to be understood as condemning the general practitioner who conscientiously prepares himself for orthodontic practice and thereafter engages in it, and I applaud those who, in a rural community in which there are patients who cannot reach a specialist, have a high enough sense of duty to prepare themselves properly to give orthodontic service to as many as they can find time for. My only contention is that those men are not justified who, located where orthodontic specialists are available, attempt to cover this field without at least as much preparation as an assistant who devotes all his time to orthodontia under the direction of an experienced man or, in lieu of that, devotes at least a year to postgraduate study in some institution in which he can receive intensive training. Orthodontists will undoubtedly be accused of self-interest when they condemn general practitioners who undertake the treatment of orthodontic cases without due preparation; nevertheless I believe it is true that the highest type of men in this specialty really have in mind

the welfare of the patient and the public generally and are not thinking whether or not their incomes will suffer. I am on record and I still believe that the public who need it are just as much entitled to free health service as they are to free education; indeed I think it comes before education in importance. But I am unalterably opposed to any service, free or otherwise, being offered to the public which is not of the highest type. It is important that education be upon a high level, but this is even more important with respect to health service; and until the highest type of health service can be offered free to those who cannot pay for it, it is better to refrain from offering any.

Finally, it is our duty even at the risk of being thought mercenary to educate both the public and the kindred professions so that they will know how to distinguish between a genuine and conscientious service and one that is tinged with commercialism. Means for such an end can better be discussed by those who have given the subject more thought than I, but if this brief paper shall serve to divert even a part of our hitherto intense concentration upon the development of efficiency in our work to its just as important social aspects, I shall feel well repaid.

833 Park Avenue

METHOD FOR AIDING AN IMBEDDED CANINE TO ERUPT WITHOUT MUTILATING OR MAKING ANY ATTACHMENT TO THE TOOTH

ARCHIE C. GIFFORD, D.D.S., OSHKOSH, WIS.

I HAVE found that if sufficient space is made for impacted premolars and if the overlying process is removed surgically, the premolars will almost immediately appear. After considering this fact, it came to my mind that if a similar procedure was undertaken for lingually imbedded canines, they

Fig. 1.

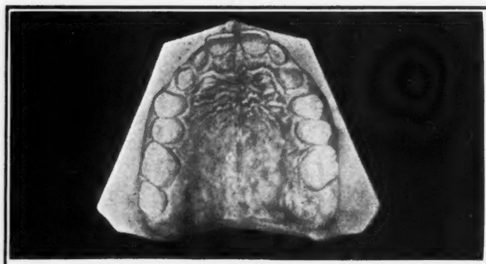
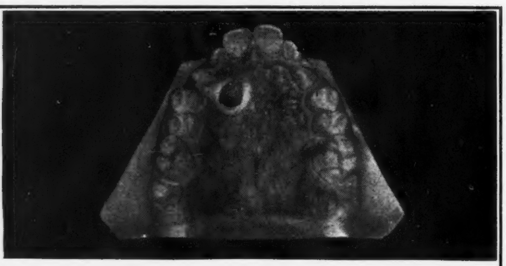


Fig. 2.



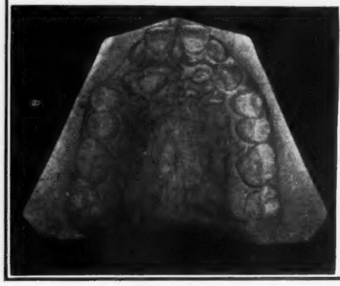


Fig. 3.

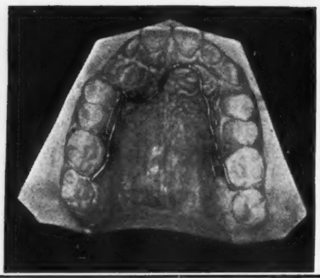


Fig. 4.

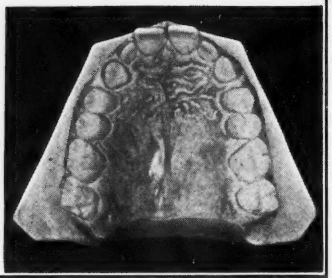


Fig. 5.

Fig. 1.—Original cast made Aug. 3, 1932.

Fig. 2.—After the deciduous canine was removed, surgical interference was performed. In this case the osseous structure was removed through to the socket of the deciduous canine, Aug. 3, 1933. For clinical purposes this illustration is somewhat exaggerated.

Fig. 3.—Eighty-seven days later, patient returned for observation. Nothing had been done during that time. Note the healthy tissue like that of a normally erupting tooth.

Fig. 4.—Ninety-seven days later, this appliance was removed to be replaced by one of a simpler design.

Fig. 5.—Fifteen months and twenty-two days after the first appliance was placed, appliance was removed to allow the tooth to elongate to its desired position.

should erupt to a position that would facilitate directing them to their correct positions in alignment. These canines will come to the surface if there is nothing overlying them to prevent their eruption.

In Fig. 1 is shown the cast of a patient sixteen years old; in this case there was sufficient space to bring the tooth into the proper line of occlusion. In other cases, if there is not enough space, it should, of course, be provided before surgical interference is undertaken.

Clinic presented at the Thirty-Fourth Annual Meeting of the American Society of Orthodontists, St. Louis, April 20-23, 1936.

I prefer to perform this surgical procedure under block anesthesia in order to have a good view of the field of operation.

With a lancet of fair size and rigidity, enough of the soft tissue overlying the tooth should be removed to assure a clear field. With a small round surgical bur, the operator starts as near the point of the cusp of the impacted tooth as he can reasonably determine from a correctly made occlusal roentgenogram. By following around the tooth, encircling the crown with this small bur, he can uncover the tooth to a point where there is no interference with the osseous structures. He must always remember to be careful not to excise below the enamel junction; better not far enough than too far. The

A. *B.*

C. *D.*

Fig. 6.—*A,* June 23, 1932; *B,* Oct. 25, 1932; *C,* Feb. 1, 1933; *D,* Sept. 30, 1933.

portion most liable to be damaged is that part of the root nearest the surface on a line with the long axis of the tooth, usually the distal surface or that portion presenting distally if the tooth is in a position parallel with the other teeth. The process underneath does not need surgical interference, but the operator must be certain that the cusp is released. After the operation is completed, the wound does not need to be dressed or packed; for, if surgical cleanliness is followed, there is no cause for infection and the tissues do not regenerate enough to interfere with the eruption of the tooth.

If the operator has any anxiety concerning the surgical outcome, the patient can be seen four or five days later to check up on the wound. The pa-

tient should be given an appointment for ten or twelve weeks later; when he returns, the tooth will have erupted to a position similar to that shown in Fig. 2 if the operation has been carefully done.

Since we know that there is no attachment of the enamel to the surrounding structure, there is no need to place any attachment directly to the tooth. By constructing an appliance similar to the one shown in Fig. 4, which was the original appliance used in this case for a period of ninety-seven days, with a finger spring of 0.002 attached to slide underneath the tooth to be moved, it is surprising with what rapidity the misplaced tooth will move to the desired position if careful consideration is given to the adjustment of the finger spring.

Fig. 5 shows the tooth in this case after it was in the desired position, yet not of the correct length according to the teeth on either side. The appliance was then removed to give the tooth an opportunity to finish its normal growth. If the tooth is rotated, the operator can use his favorite attachment to correct the rotation, as though it were a normally erupted canine.

In Fig. 6 roentgenograms show the process of tooth movement over the period of dates indicated. Note the desired consistency of the bony structure during the treatment of the case.

The operator must always be cautious, yet not be afraid of doing harm. He must at all times consider that he is operating on living tissue at a time when the patient is in the process of growth. He must be mindful of the fact that forethought and common sense are needed to obtain the desired end-results.

If an oral surgeon were removing the tooth in this particular case, the wound would be much larger than that reasonably expected in the procedure outlined here.

46 Washington Blvd.

ORTHODONTIC TREATMENT OF SOME CLEFT PALATE AND FRACTURE CASES

FRANK S. CARTWRIGHT, D.D.S., M.S., DETROIT, MICH.

THE purpose in presenting these three case reports is to show some of the possibilities of orthodontic treatment as an aid to the oral and plastic surgeon for the making of better facial corrections in unusual cases. I feel that this branch of orthodontic technic, so little practiced, not so lucrative, perhaps, as other branches of the art, should be encouraged.

CASE 1.—This case well illustrates the benefits derived from orthodontic treatment which was instituted after surgical treatment of a harelip and cleft palate.

History and Etiology.—Boy sixteen years of age, with a congenital unilateral cleft palate and harelip. The father, mother, sister, and brothers have normal occlusion; there were no other cleft palates in the family so far as the parents could recall. Three or four surgical operations were performed during infancy and early childhood for proper closure of cleft and harelip.

Description and Procedure.—The facial expression and muscle tone before orthodontic treatment are shown in Fig. 1. Note the protruding mandible and lip and the retruding maxilla and lip, also the deviated nasal construction. Fig. 2 shows views of the malocclusion of the teeth and jaws. A mandibular labial arch was fitted to buccal tubes on molar bands, and a maxillary lingual arch was fitted to half round tubes on the maxillary molar bands. Intermaxillary elastic pressure, together with lateral expansion of maxillary lingual arch and lingual contraction of mandibular labial arch, was used in order to place the teeth in better occlusion.

For esthetics, better function, and retention a bridge was constructed from maxillary canine to canine and a piece of "luxene" was used to fill out the maxillary anterior region, thus giving a more normal appearance to the upper lip. See Figs. 3 and 4. The duration of treatment was about one year.

Prognosis.—Fig. 4 shows views of the patient about fifteen months after plastic surgery, orthodontia, and general dentistry had been completed. An efficient, fairly esthetic denture has been effected, and there is no reason to expect a relapse.

CASE 2.—This case illustrates benefits derived from orthodontic treatment prior to oral surgery, thus preparing a better field for operation.

History and Etiology.—Boy thirteen years of age, with a congenital unilateral cleft palate and harelip (Fig. 5). Up to the age of thirteen years no oral operations were attempted to correct this malcondition. The father,

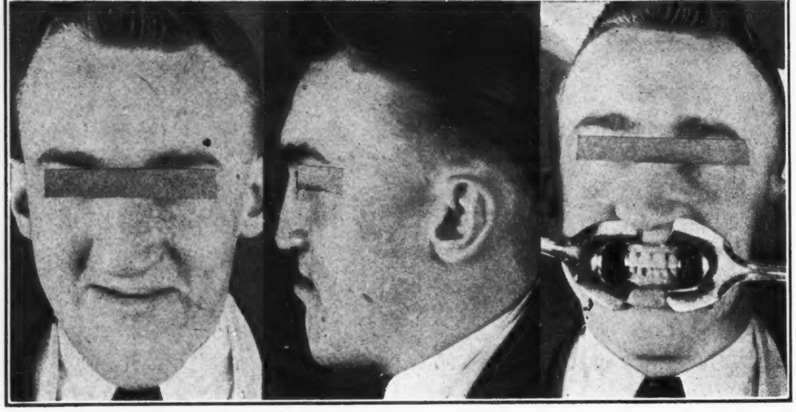
Presented before the American Society of Orthodontists, St. Louis, April 20-23, 1936.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.



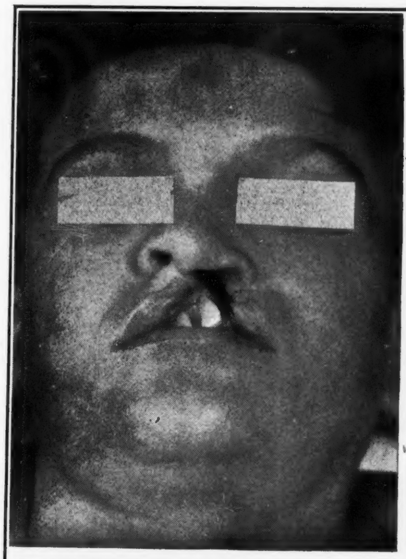


Fig. 5.

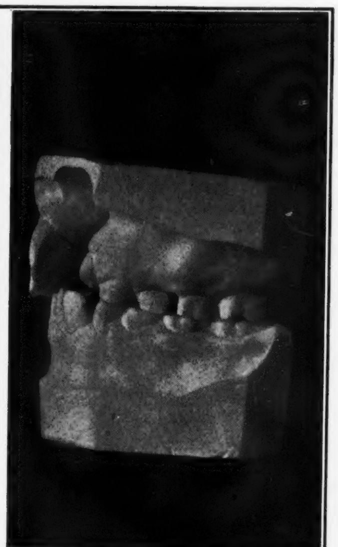


Fig. 6.

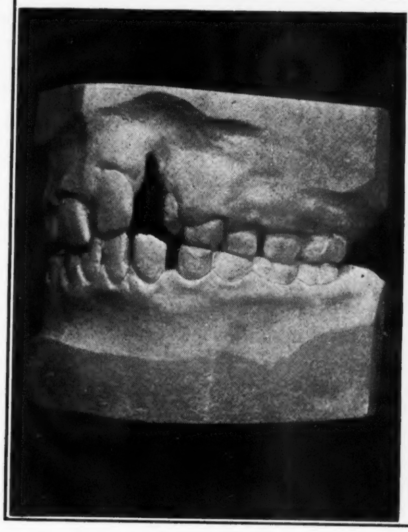


Fig. 7.

Fig. 8.

Fig. 9.

mother, sisters, and brothers had normal facial development. No recollection by parent of any history of similar case in the family.

Description and Procedure.—Casts in Fig. 6 show side view of cleft. Bands were made for the maxillary first molars, a lingual arch was attached for stabilization and a semi-high labial arch was fitted to buccal tubes; auxiliary spring wires were soldered to the labial arch in such position as to lie flat on the labial surfaces of the teeth in premaxillary bone, giving pressure lingualward and toward line of cleft, thus bringing the teeth and premaxillary bone into more normal position as shown in Figs. 7 and 8. The greatest width of the cleft was reduced from 9 mm. to 5 mm. The time of orthodontic treatment was six weeks (Fig. 9). After this reduction in cleft by means of orthodontic treatment, the remaining cleft was completely closed by an oral surgeon.

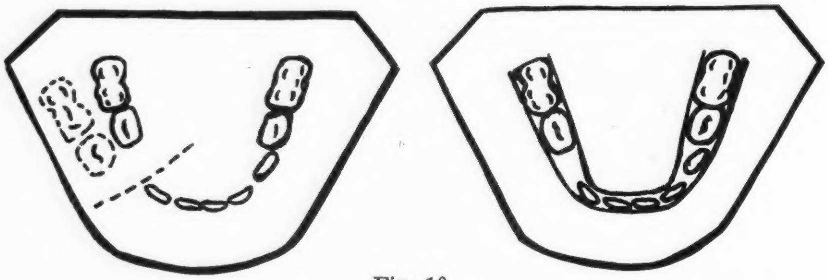


Fig. 10.

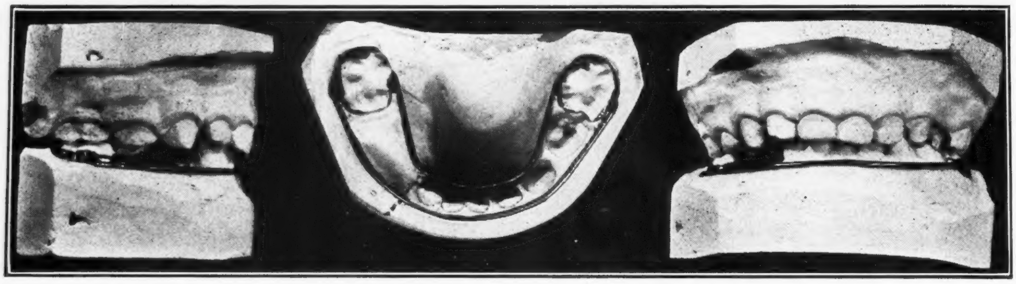


Fig. 11.

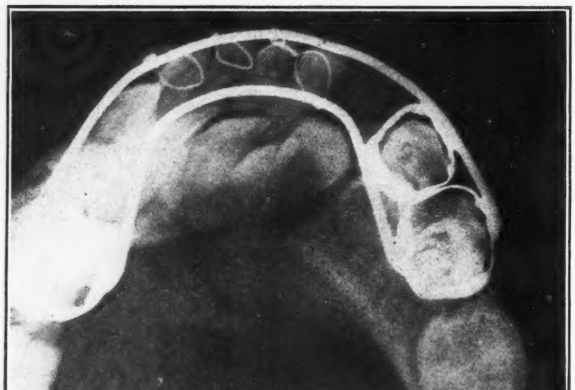


Fig. 12.

CASE 3.—This illustrates how an orthodontic appliance was used in the treatment of a right unilateral fracture of the mandible.

History and Etiology.—Boy, aged five years. Before automobile accident he had normal occlusion.

Description and Procedure.—The unilateral fracture between deciduous right canine and deciduous molar teeth is shown in Figs. 10-12. Impressions of the maxillary and the mandibular teeth were made, and casts were poured. On the plaster model the mandibular right molars on the fragmented portion were cut off and replaced on the model into proper occlusion with the maxillary teeth. Molar bands were constructed, and a lingual and a labial arch were soldered to them (Figs. 10 and 11). The fractured jaw was then placed in proper position, using the teeth as a guide, and the bands with the arches were cemented to place. Stainless steel ligature wires were used to ligate all mandibular teeth to the labial arch.

Prognosis.—The fracture healed quickly and satisfactorily with minimum discomfort in five weeks.

USES OF THE WIRE CRIB APPLIANCE

W. B. STEVENSON, D.D.S., AMARILLO, TEXAS

THIS case was rather complex in nature, and to add to the perplexity it required a two-hundred-mile trip by auto for each visit to the office. The case has not been completed, but shows what has been accomplished in a little more than two years with the appliances used.

The removable appliance has its advantages but should not be considered as a universal appliance by any means. The greatest advantages of the removable appliance, as I see it, are the mild stimulation of growth and, at the same time, the freedom of tooth movement. This allows the cusps and incline planes to seek a physiologic cusp relation, and in addition to this there is the advantage of its simplicity, cleanliness, inconspicuousness, and ease of adjustment.

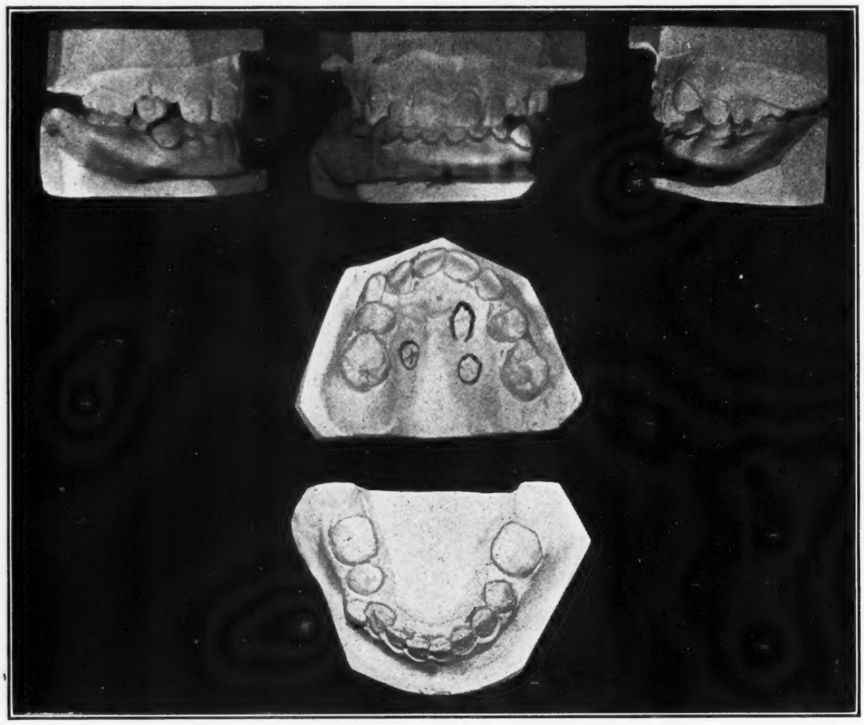


Fig. 1.—Models showing case before treatment.

The general principle of the wire crib appliance is little different from that of the lingual appliance; since it will carry fingersprings, the labial loop, or the bite plane.

The object in selecting this particular case was to show the application of certain basic principles of expansion, opening of spaces, and rotation of teeth.

Presented at the Thirty-Fourth Annual Meeting of the American Society of Orthodontists, St. Louis, April 20-23, 1936.

Diagnosis.—The patient was fourteen years of age at the time she came in for treatment. It was found upon an examination of the study models and x-ray pictures that the maxillary second bicuspids and maxillary right cuspid were impacted, and all were found to be in the palatine portion of the maxilla. The

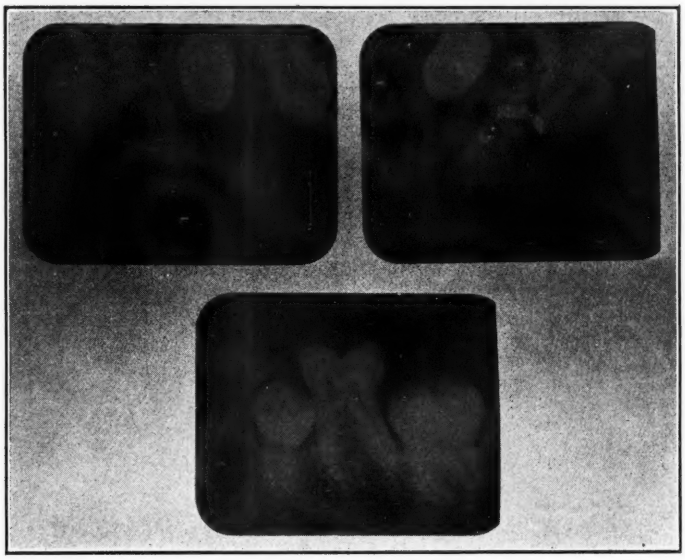


Fig. 2.—X-ray pictures showing impactions.

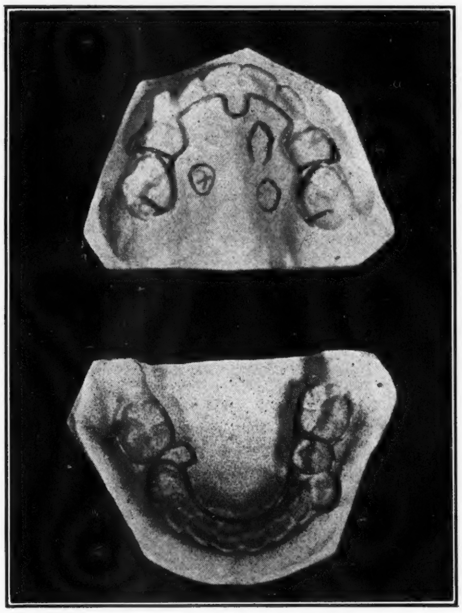


Fig. 3.—Models with original appliances.

spaces for the bicuspids were entirely closed, and there was only 3 mm. of space for the maxillary right cuspid. The maxillary left first bicuspid had erupted buccally with only 3.5 mm. of space between the cuspid and the second bicuspid. The maxillary first molars were rotated.

In the mandibular arch the right mandibular first bicuspid was erupting buccally with only 2.5 mm. of space, and the left mandibular second bicuspid was erupting lingually with 1.5 mm. of space for it.

Proposed Treatment.—It was planned to rotate the maxillary molars, widen the arch, and open spaces for the second bicuspids and cuspids, and to widen the mandibular arch and open spaces for the bicuspids.

Appliances.—Wire crib appliances were selected. The body wire of chrome alloy was 0.036 round wire, with clasps of the same material, but 0.025 in size.

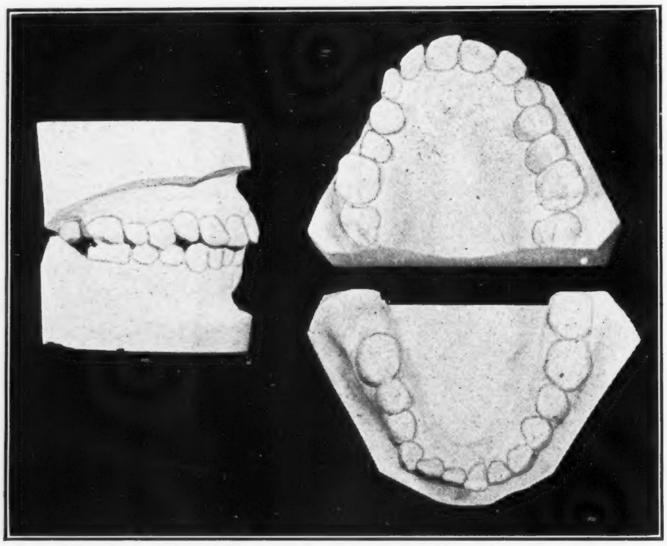


Fig. 4.—Models showing case after two years' treatment.

Fingersprings for opening spaces and rotating were 0.020 as the spaces were opened and as the impacted teeth made their appearance; then fingersprings were added to guide them into place. Occlusal rests were used on the molars to prevent the wires from impinging on the gums.

Adjustments were made two to four weeks apart. It is advisable to use the millimeter gauge when making adjustments, especially when opening loops. The principle of adjustment for the removable type is no different than that for other appliances. Forces must be known and applied only where their reactions are desired for developmental changes as the result of pressure stimuli.

MINIATURE CAMERA POSSIBILITIES

A. C. BROUSSARD, D.D.S., NEW ORLEANS, LA.

IN PRESENTING this clinic it is not my intention to convey the idea that the clinical camera and projecting glass slides be discarded, as each has its merits. It is principally intended for those whose office space does not permit an elaborate equipment or whose finances are limited.

Fig. 1.


Fig. 2.

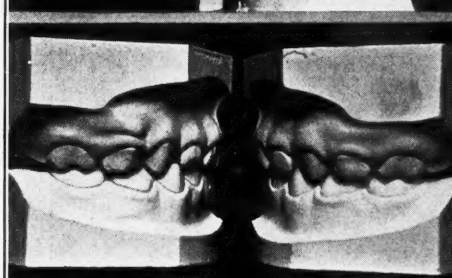
Fig. 3.


Fig. 4.

Fig. 5.

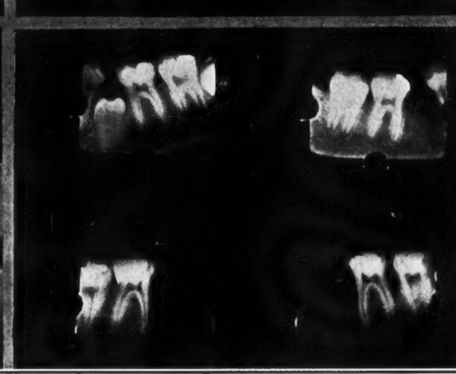


Fig. 6.

Fig. 1.—Profile of patient in the dental chair taken at a distance of two feet.

Fig. 2.—Photograph of teeth taken at seven and one-half inches from camera using a supplementary or portrait lens.

Fig. 3.—A double exposure of cast, showing right and left views in one frame.

Fig. 4.—A triple exposure of cast, showing right, front, and left views in one frame.

Fig. 5.—Triple exposure showing right and left views of cast and x-ray pictures of the case in one frame.

Fig. 6.—X-ray pictures photographed from a view box.

Clinic presented at the Thirty-Fourth Annual Meeting of the American Society of Orthodontists, St. Louis, Mo., April 20-23, 1936.

The miniature camera offers unlimited possibilities. It can be developed to suit one's purpose and become a real fascinating hobby whether it be for outdoor work or in a dental office for photographing patients, oral conditions, teeth, appliances, casts, x-rays, glass slides, and copy work.

The film is the standard 35 M.M. film and can be used for office records by enlarging to convenient size and also for projection instead of the regular glass slides.

The camera in use is the Ansco Memo, which takes fifty pictures on one roll of film. There are a number of similar cameras on the market taking

Fig. 7. Fig. 8.

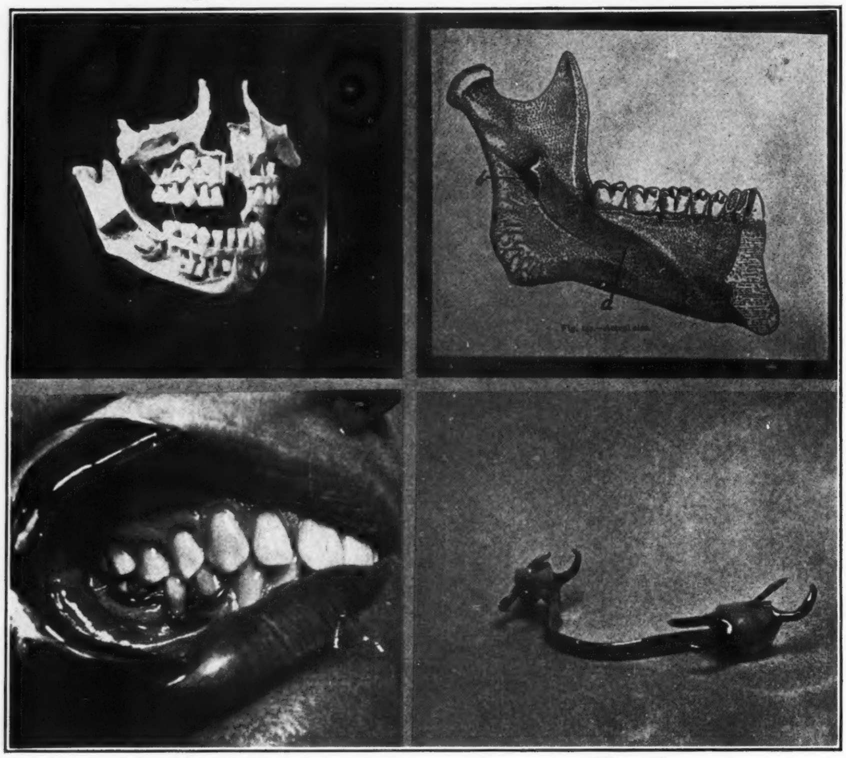


Fig. 9. Fig. 10.

Fig. 7.—Glass slides photographed from a view box.
Fig. 8.—Copy from a textbook.
Fig. 9.—Oral photograph of restoration in the mouth.
Fig. 10.—Photograph of the restoration.

from thirty to fifty pictures on one roll and ranging in price. For copy work a 6.3 lens camera can be bought and is very satisfactory. A fast lens is unnecessary for copy work.

For screen projection a positive film is printed from the negative and used with a still film projector. With a simple and inexpensive equipment, a roll of fifty pictures can be taken, developed and printed on a positive film for projection for less than two dollars; while the regular glass slides cost about seventy-five cents each. This is worth considering by those who use slides, besides the ease of carrying a small film roll in the vest pocket instead of a box of valuable glass slides.

Figs. 1 to 10 show some of the possibilities of this small camera.

An inexpensive copy board can be made as shown in Fig. 11, and objects can be taken at various distances, depending on size of objects, by using supplementary or portrait lens. Some cameras have demountable lens and extension tubes that can be used for copy work instead of the supplementary or portrait lens.

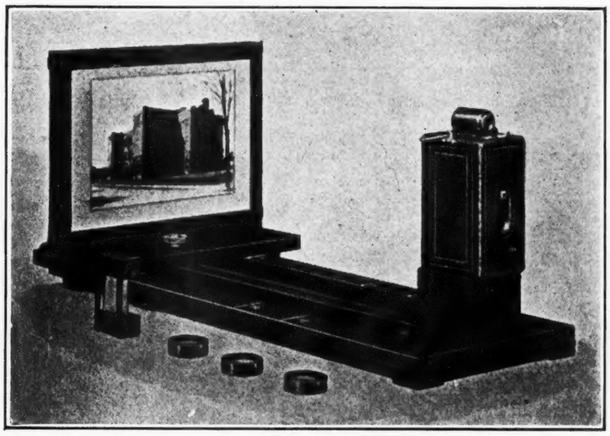


Fig. 11.—A copying board.

Some glass slides are very valuable. In such cases photographs of these slides can be made as in Fig. 7 and projected with the film while the slides can be left home for safe keeping.

1116 Maison Blanche Bldg.

DIAGNOSTIC CHART PROTECTING THE ORTHODONTIST

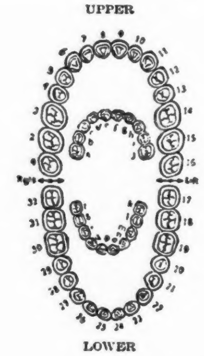
Homer B. Robison, D.D.S., Hutchinson, Kan.

I AM submitting this diagnostic chart not as being something new in its entirety but in the hope that a few of its suggestions may be of help to some one.

Dr. Homer B. Robison
PRACTICE LIMITED TO ORTHODONTIA
619 RORABAUGH-WILEY BLDG.
HUTCHINSON, KANSAS

NAME			CASE NO.
ADDRESS			TEL. NO.
REFERRED BY		ADDRESS	
PARENTS			
OCCUPATION		BANK	
DATE EXAM.	TIME ESTIMATE		APPL. FEE
AGE	B. D.		
SCHOOL		GRADE	
HEIGHT	NORMAL	WEIGHT	NORMAL
SISTER	BROTHER		NO. OF CHILD.
FAMILY HISTORY			
HEREDITARY MANIFESTATIONS			
CLASSIFICATION			
CAUSE			
PREDISPOSING CAUSE			
GENERAL HEALTH			
ORAL HEALTH		TOOTH CONDITION	
DIET			
INF. FEED—BREAST		BOTTLE	
NASAL PASSAGE			
NOSE	LEFT	RIGHT	MED. LINE
ADENOIDS		TONSILS	
SINUS			
MUSCLES DEF:	SUP. LEVATOR		ORBIC. ORIS
	DEPRESSOR NARIES		DILATOR NARIES
	DEPRESSOR ORIS		DEPRESSOR MENTI
	SUP. HYOID		INF. HYOID
HABITS		SPEECH	
MODEL NO.	X-RAY NO.		PHOTO NO.
IMPRESSIONS			
UPP. APP. PLACED		LOW. APP. PLACED	
UPP. APP. REMOVED		LOW. APP. DEMOVED	

UPPER



LOWER

I wish especially to recommend the use of the diagram of the dentition as a protection to the orthodontist as well as a safeguard to the patient, permitting and facilitating a periodic check-up.

Clinic presented before the American Society of Orthodontists, St. Louis, April 20-23, 1936.

A NEW ORTHODONTIC SYMMETROSCOPE*

Dr. G. Korkhaus, Bonn, Germany

FOR orthodontic diagnostic analysis, certain instruments—well known as symmetroscopes and symmetrographs—have been proved, for a long time past, to be of great value in the measurement of models and for the examination of the symmetry of their proportions. Ten years ago I constructed a symmetrograph which, with its additional parts, has proved to be very exact and reliable, and of which it can be said, without exaggeration, that it has

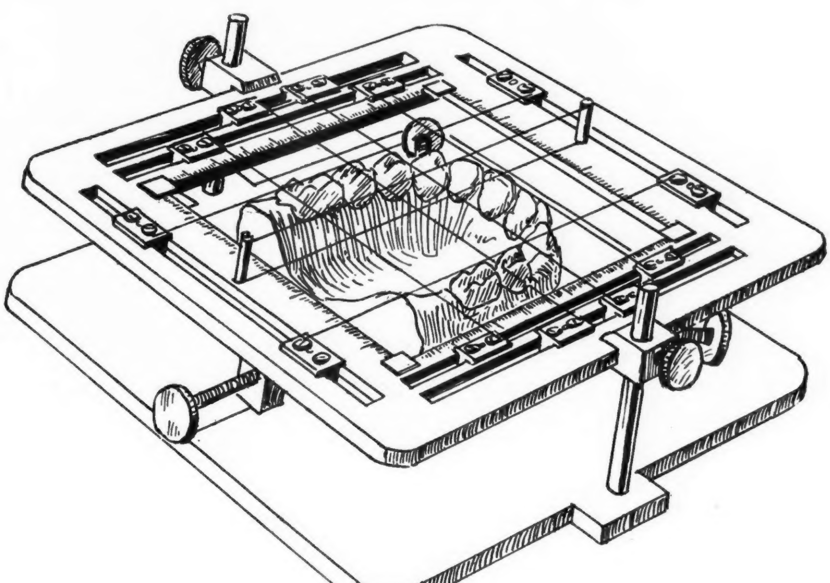


Fig. 1.

yet to be surpassed. This instrument, however, has one fault; it is a little too expensive. This is a serious objection, as it has prevented the popularization of the use of these diagnostic methods among orthodontists.

I have now endeavored to construct a symmetroscope avoiding the disadvantages of previous models (designed by Grünberg, Friel, Zielinsky and Zawitzky), but based upon the same principle of aligning the different points and lines with the help of cross-wires. A square opening surrounds the model which is fixed to a base plate. A number of fine wires—running parallel to each other—are so fastened that they can be shifted over a millimeter scale in both a sagittal and a transverse direction; so that all distances in a sagittal

*Demonstration before the European Orthodontological Society, Scheveningen, 1934.

and transverse direction, and by comparison all deviations in these directions, can be read off without difficulty. (Figs. 1 and 2.)

The actual measuring plate with the wires can be lowered to the occlusal surfaces of the teeth, errors of parallax being thereby rendered negligible.

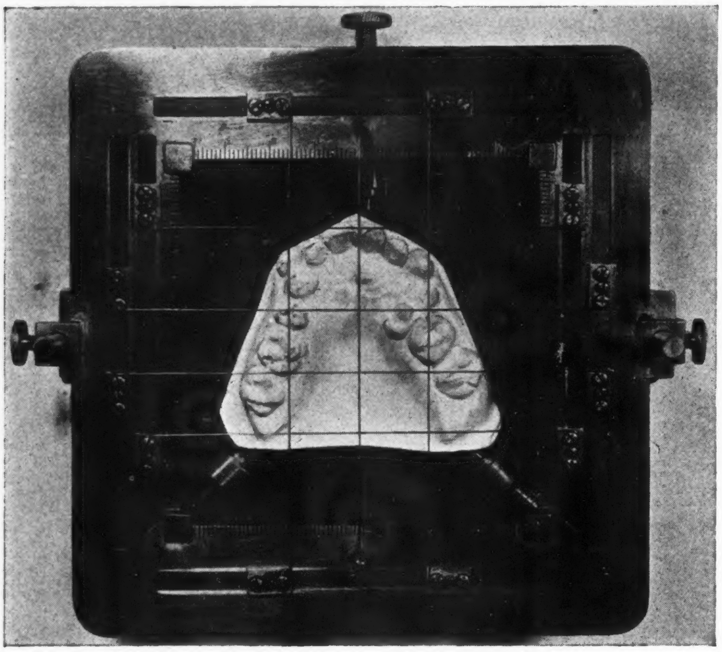


Fig. 2.

This measuring instrument can be used with good results for all purposes of diagnostic investigation of a model, and has the great advantage of being considerably cheaper than the symmetrograph.

Department of Oral Surgery

Edited by

Robert H. Ivy and Kurt H. Thoma

Articles on oral surgery, radiography, and anesthesia should be submitted to Dr. Robert H. Ivy, 1930 Chestnut St., Philadelphia, Pa. Articles on oral pathology should be submitted to Dr. Kurt H. Thoma, 47 Bay State Road, Boston, Mass.

ROENTGENOGRAPHIC VARIATIONS OF THE MAXILLARY SINUS AND THE NUTRIENT CANALS OF THE MAXILLA AND THE MANDIBLE

LeRoy M. Ennis, D.D.S., Philadelphia, Pa.

Assistant Professor, Dental Roentgenology, University of Pennsylvania

THE anatomy of the maxillary sinus must be thoroughly understood by the dentist to enable him to render an intelligent opinion in numberless cases of suspected disease changes in the maxillary dental arch.

The maxillary sinus, being the largest of the paranasal sinuses, and subject to structural and pathologic variations found in the other sinuses, presents a series of special problems by reason of the relationship it bears to the teeth.

The sinus being present at birth enlarges until, at about the age of six years, it has descended to the level of the middle nasal meatus; and by the age of puberty it has expanded inferiorly until its floor is on a level with the floor of the nose. In adult life it is found to have descended below the level of the floor of the nose, into the alveolus. The expansion sometimes continues into the palate, and into the tuberosity behind the third molar. These extensions are of cardinal importance to the clinician when interpreting roentgenograms of this region. Arrest of development through inherited factors or through disease may cause considerable alteration in the roentgenologic appearance. Variations in the principal skull diameters may so alter the shape of the maxillary sinus that different individuals may have sinuses of the same shape but of totally different radiographic appearance.

The anatomist and the rhinologist, with their respective points of view, have contributed valuable information concerning the maxillary sinus; but to the average dentist their observations are a veritable maze, his interest being almost entirely in a more definitely limited phase of these studies.

Clinical observations have been collected to permit an advanced evaluation of information pertaining to the maxillary sinus, and it behooves every dentist to acquire an intensive knowledge of the relative size, the conforma-

tion, the location of the sinuses, and the physiologic, anatomic, and pathologic conditions pertaining to them and to the structures and the regions contiguous to them. The dentist must know from the angle of the roentgenologic examination how to interpret the shadows that may develop on the film, how to recognize the distinguishing points whereby the normal structure may be differentiated from the pathologic change.

By a discussion of parts in the anatomy of the sinus from the angle of the roentgenologic examination, designating shadows that may develop on the films and dwelling on the distinguishing points whereby the normal structure may be differentiated from the pathologic change, it is hoped that this article may contribute to a better understanding of the problem.

The maxillary sinus, as we all know, is a cavity of varying dimensions always present in the maxilla, its extension or enlarging process accompanying the growth of the face.

At birth, it exists merely as a slitlike indentation upon the outer wall of the nasal fossa; for at this period of life the maxilla is made up almost entirely of the alveolar process, the sockets of the unerupted teeth being almost in contact with the orbital plane of the maxilla.

Its presence and the phenomena of its growth are observed even earlier; for Schaeffer even indicates that about the seventh day of fetal life the maxillary sinus begins to grow from the evagination of the mucous membrane of the floor or lateral wall of the ethmoidal infundibulum, forming a primitive pouch. Occasionally two such pouches form the fusion of same, probably explaining the rather rarely met double adult maxillary sinus, each part of which has its independent ostium.

We observe the maxillary sinus developed in width to reach below the orbit by the age of one year, although not beyond the position of the infraorbital canal; and by the twentieth month it develops further posteriorly to the position of the rudimentary first permanent molar.

There is a very conspicuous growth in width during the third and fourth years, which progresses increasingly thereafter until, at the seventh year, we note an average width of 18 mm., an average height of 17 mm., an average length of 27 mm.

The size and the growth of the maxillary sinus progress proportionately with the progress of age and dentition; although, until the teeth erupt and the alveolar process develops, little space avails for this sinus. We know the process goes on, developing downward until, about the age of puberty, or about the time practically all permanent teeth save the third molar have erupted, the floor of the sinus is on a level with the floor of the nose.

The adult maxillary sinus, the largest of the paranasal sinuses, resembles in general a three-sided pyramid, lies laterally to the outer side of the nasal fossa, occupying a greater part of the maxilla, its walls of varying thickness.

A delicate vascular mucoperiosteal layer—a ciliated epithelium containing mucous glands—lines the sinus, its deeper portion serving as a periosteal covering of the cavity. This lining is continuous with the lining membrane of the middle meatus through the ostium maxillare.

The median wall or base is directed toward the nasal fossa, the apex of the pyramidal shaped cavity lying at the zygomatic process of the maxilla. The upper or orbital wall is often modelled by the ridge containing the infraorbital canal; the anterior wall is toward the face and is varyingly impressed by the canine fossa. Although often reduced by the extensions of the sinus into the adjacent alveolar process, the posterior inferior wall is normally the thicker.

Fig. 1.

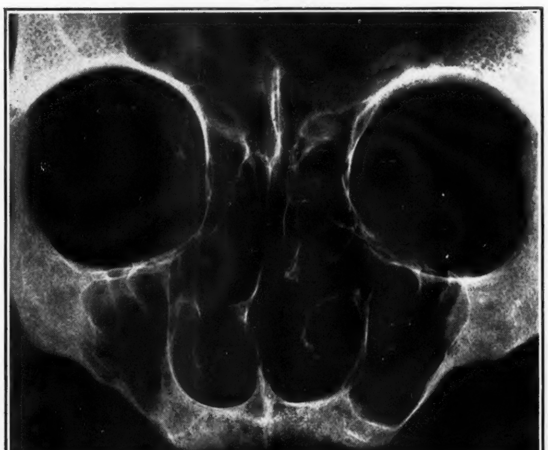


Fig. 2.

Fig. 1.—Vertical section of a skull revealing the resorption of the alveolar process causing the maxillary sinus to recede. The floor of the nasal fossa is practically on a level with the floor of the maxillary sinus. The nasal septum is deflected to the left, causing probably the left maxillary sinus to be much smaller than the right.

Fig. 2.—Alveolar extension of the maxillary sinus, showing lateral view of the maxillary sinus with a decided alveolar extension. The floor of the maxillary sinus is decidedly below the floor of the nose in the region of the second molar.

When considering conditions connected with the sinuses, the dentist must keep in mind the fact that they vary greatly in size in different individuals, and quite often in the two sides of the face of one person (Fig. 1); and also that they become modified by local enlargements so as to lose the typical pyramidal appearance.

Zuckerkandl discusses these extensions of the maxillary sinus as (1) alveolar, (2) palatine, (3) zygomatic, and (4) infraorbital.

Because of its great dental significance, we add to that classification still another—the tuberosity extension.

As presented by Zuckerkandl, the alveolar extension is produced by the hollowing out of the alveolar process. (Fig. 2.) Occurring after the age of puberty mostly, and observed most prominently in the region of the first molar, the sinus often extends into the bifurcation of the roots of the first molar. (Fig. 3.) Roentgenograms made after extraction of the first molar show the sinus extending further into the alveolar process (Figs. 4 and 5), sometimes almost to the crest of the alveolar ridge (Figs. 6 and 7), and it is extremely important that this particular extension be recognized as such, for the uninformed may interpret it as a cystic area or some other pathologic lesion.

Fig. 3. Fig. 4. Fig. 5.

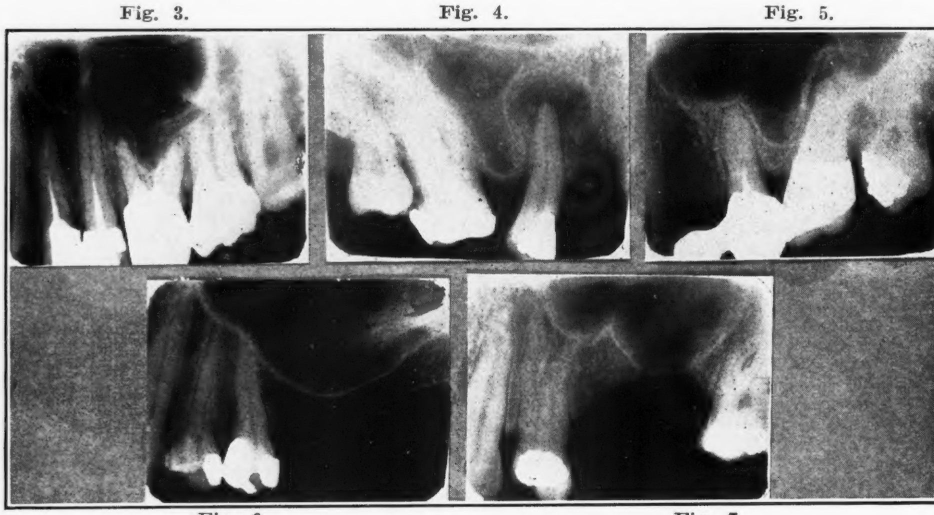


Fig. 6. Fig. 7.

Fig. 3.—Septum of the maxillary sinus over the second premolar, dividing the maxillary sinus into two parts, the posterior portion of the sinus extending down into the bifurcation of the roots of the first molar.

Fig. 4.—A decided alveolar extension of the maxillary sinus in the region of the missing maxillary first molar. There is also a definite area of granulation tissue with a rarefying osteitis over the apical region of the premolar.

Fig. 5.—Alveolar extension of the maxillary sinus, the sinus tipping into the alveolus in the region formerly occupied by the maxillary first molar.

Fig. 6.—Indicating the loss of the three maxillary molars and a decided alveolar extension of the maxillary sinus, showing a very small amount of bone remaining between the maxillary sinus and oral cavity.

Fig. 7.—Showing decided alveolar extension of the maxillary sinus with a small septum in the sinus in the region of the second premolar causing the sinus to appear as though it had a decided elevation in its floor.

The excavation of the floor of the nasal fossa by the extension in the alveolar process between the plates of the hard palate is termed the palatine extension. This is more apparent in the anterior third of the palate (Fig. 8) and may extend over to the median line of the palate, appearing in the roentgenogram as a continuation of the anterior portion of the maxillary sinus (Figs. 9 and 10).

In 1930, Ennis suggested that this area could be determined and distinguished from a cystic area by following the outline of the typical Y that

develops on the roentgenogram as the line of the inner wall of the sinus reaches the region of the first premolar (Fig. 21).

An occlusal film assures clearer indication and surer interpretation of this; and because this palatine extension is less common than the alveolar extension, extreme caution must be used to guard us against misinterpretation of this condition.

The designation of infraorbital extension covers the encroachment of the sinus into the frontal process of the maxilla.

Fig. 8.

Fig. 9. Fig. 10.

Fig. 8.—Roentgenogram of specimen showing the maxillary sinus extending toward the median line in the palatal plate. The extension is greater on one side than on the other.

Fig. 9.—A palatine extension of the maxillary sinus showing the sinus extending toward the median line from the lateral wall of the nose, designated *L* in the roentgenogram. *D*, the lacrimal canal in the lateral wall of the nose.

Fig. 10.—The palatine extension of the maxillary sinus, marked by arrows. The lacrimal canal has been slightly distorted and appears as an elongated radiolucent shadow (*L*). The typical Y formation dividing the maxillary sinus from the nasal fossa may be observed over the apical region of the canine. The palatine extension may be seen anterior to this region and superimposed over the nasal fossa.

While seemingly of less importance than the other two already mentioned, the alveolar extension and the palatine extension, it is very necessary that the operator be able to interpret this infraorbital extension clearly, for sometimes it forms a typical pocket between the infraorbital canal and the inner wall of the sinus. Failure to recognize this condition may be serious;

for, when posterior anterior views of these sinuses are being made, the pocket may cast a shadow over the nares and the ethmoidal sinus, which, improperly interpreted, may be taken for an abnormal lesion that would lead to an unjustifiable surgical procedure with results that may prove dire.

Omitting comment on the zygomatic extension, because of its minor significance to the dentist, we come to consideration of the tuberosity extension.

Although we find that the posterior inferior wall of the sinus is usually the thickest (Fig. 2), in numerous examinations we discover the sinus extending so far into this wall as a tuberosity extension that it causes a thinness not only of the posterior inferior wall (Fig. 11) but also the supporting structure of the third molar, and sometimes, the second molar (Fig. 12).

When it becomes necessary to extract the teeth of this region, recognition of this condition is impressively important, because owing to the thinness of the alveolar plates and the posterior wall of the sinus (Figs. 13 and 14), the

Fig. 11.—Lateral view of the maxillary sinus showing a rather large sinus with extensions in practically all directions. The tuberosity extension is rather marked, making the posterior inferior wall rather thin.

plates may fracture and come away with the teeth, leaving a large opening in the alveolar process with only the mucoperiosteal lining separating the sinus from the oral cavity.

Thus, later, after the tissues have been restored, there would be practically no alveolar ridge upon which a denture could be constructed. There would remain merely a flat plane. But with a thorough understanding of this tuberosity extension, teeth may be removed surgically without a great loss of their bony support.

When it is necessary to perform an alveolectomy in an edentulous mouth with such a bulbous tuberosity of the maxilla, it is critically essential that we ascertain the presence or absence of any tuberosity extension of the sinus; for otherwise the operator may find himself making an opening into the maxillary sinus. Especially might be noted cases in which the maxillary sinus seems particularly large, a condition due to an extreme hollowing out of

the sinus in all directions (Fig. 11). This creates a condition of thinness of the sinus walls, with the extensions markedly developed; and it should be obvious that no attempt to operate in the molar or premolar regions should be made without a thorough roentgenographic study.

The mere enumeration of these anatomic variations of the maxillary sinus should impress the dentist with the high requirements of information and knowledge relative to the entire regions, and with the fact that less than a thorough knowledge spells danger.

While not nearly so important from the angle of dentistry as are these enlargements, which govern our operative procedures, nevertheless we must not ignore the distinguishing cases in which less developed or more contracted conditions of the sinus are manifested (Fig. 15). Many and varied causes conduce to bring about these conditions. They may be due to imper-

Fig. 12*A*. Fig. 12*B*.

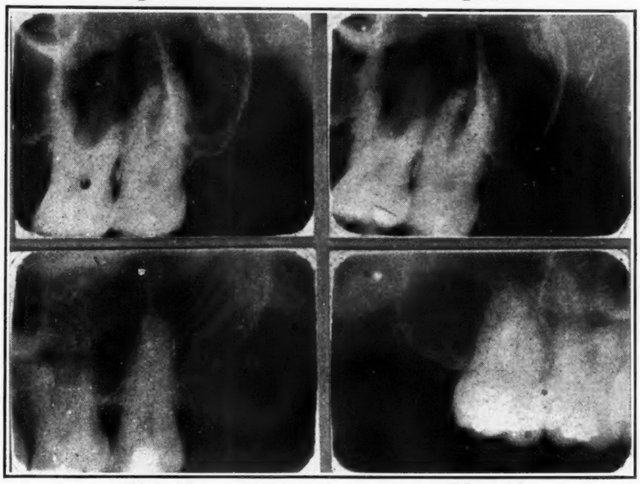


Fig. 13. Fig. 14.

Fig. 12.—A decided tuberosity extension, revealing a septum over the third molar, and the posterior wall of the sinus very thin.

Fig. 13.—Tuberosity extension of the maxillary sinus, extending decidedly posterior to the third molar.

Fig. 14.—Tuberosity extension of the left maxillary sinus which was diagnosed as a cyst.

fect absorption of the cancellated bone on the floor of the sinus; or by reason of a secondary thickening of the sinus walls; or from an unusual depression of the canine fossa; perhaps from imperfectly erupted teeth; or from excessive bulging of the lateral nasal wall (Fig. 16); or from improper aeration of the sinus during growth and development due, as mentioned by Shea, of Memphis, to a nasal disease in the maxillary ostium.

In the interpretation of roentgenograms we must not overlook the least of the variations that are manifested in the maxillary sinus; the differences discovered among even normal sinuses are so great that cases of abnormal sinuses charge the operator and the interpreter with responsibility of knowing to the greatest degree the veriest detail of the anatomy of the maxilla and its surrounding structures.

We cannot possibly recognize fully the variations in the anatomic appearance of the maxillary sinus without having clearly in mind the relationship between the floor of the sinus and the floor of the nasal fossa.

About the age of puberty, the floor of the sinus is on the level with the floor of the nasal fossa. The degree of descent depends upon the degree of the hollowing out or pneumatization of the alveolar process of the maxilla.

Fig. 15.

Fig. 16.

Fig. 15.—A lateral view of the maxillary sinus, showing it to be rather small and circular. The walls in this particular sinus are very thick on all sides. Close observation will show the posterior superior alveolar artery traversing the sinus wall and its anastomosis with the anterior superior alveolar artery forming a loop anterior to the sinus, as depicted by the arrows.

Fig. 16.—Vertical section of a skull revealing an excessive bulging of the lateral walls of the nose. The palatal process in this particular specimen is rather thick. Note the nutrient canals in the walls of the sinus.

Sir Arthur Keith reports a series of measurements showing that the nasal cavities in cases of contracted palate are not shallower than usual; that their

floors, formed by the hard palate, are at normal levels, something happening to cause the alveolar bone to grow and expand more in a vertical direction and less in a horizontal direction.

From another series of measurements he concludes that one feature of these sections is seen in the downward expansion of the maxillary sinuses which, in the normal palate, descend to the level of the palatal plane but

Fig. 17.

Fig. 18.

Fig. 17.—Vertical section of the skull revealing an excessive bulging of the lateral walls of the nose and resorption of the alveolar process, causing the floor of the sinus on the right to be on a level with the floor of the nose, while on the left the floor of the maxillary sinus is considerably above the floor of the nasal fossa.

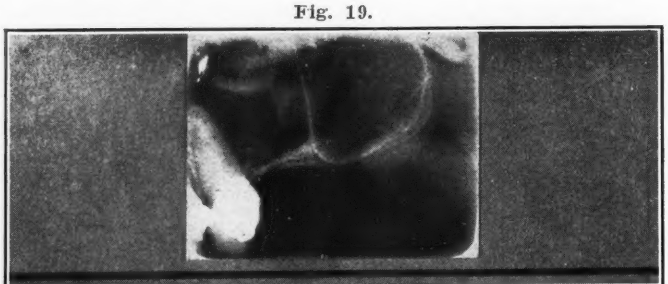
Fig. 18.—Revealing a complete resorption of the alveolar process with the floors of the maxillary sinuses and the nasal fossa being practically on the level. Note the radiolucent nutrient canals in the walls of the maxillary sinus.

which, in the contracted palate, descend 10 mm. below this plane so that in the abnormal palate the direction of growth of the alveolar bone and the expansion of the maxillary sinuses progress more vertically than in the normal palate.

We observe also that the degree of arching of the hard palate affecting, as it does, the floor of the nose, has some bearing on the relationship of the floor of the sinus to the floor of the nasal fossa.

We find a process of recession of the maxillary sinus with the resorption of the alveolar process following the loss of teeth in later years. The greater the resorption, of course, the greater the recession; so that when the alveolar process is completely resorbed, we find the floor of the maxillary sinus again on the level with the floor of the nasal fossa about as it appeared at the age of puberty (Figs. 17 and 18).

Fig. 19.



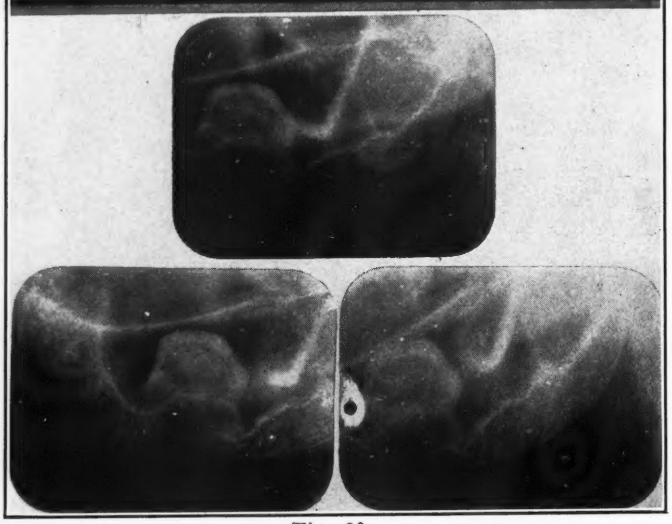


Fig. 20.

Fig. 19.—Tuberosity extension of the maxillary sinus. The molars have been extracted, leaving a very thin plate of bone between the maxillary sinus and the oral cavity.

Fig. 20.—Large septum traversing the maxillary sinus anteroposteriorly.

In considering the relationship of the maxillary sinus to the teeth, we know immediately that this relationship cannot be constant. The variations in the size of the sinuses and the variations in the teeth tell that.

The cancellated bone between the roots of the teeth and the floor of the sinuses varies in thickness in different individuals; and, if the cancellated bone be thin, the roots of the teeth form elevations on the floor of the sinus, these elevations contributing to form recesses.

The extension of the sinus into the alveolar process presents the direct communication between the roots of the teeth and the mucous membrane of the sinus. This intimate relationship between teeth and sinuses must ever be

in mind; and with a clear mental picture of the sinus, the operator will appreciate the exact number of teeth bearing direct relationship must be inconstant, depending primarily upon the size of the sinus.

Occasionally the canine tooth is found in direct relationship although not nearly so often as are the premolars. In fact, the three molars are in intimate, vital relationship with the floor of the sinus in the vast majority of cases observed.

Frequently the walls of the maxillary sinus are noticed to be uneven; recognition of this anatomic condition is important. It may be no manifestation of a pathologic lesion. The irregularities or uneven spots consist of

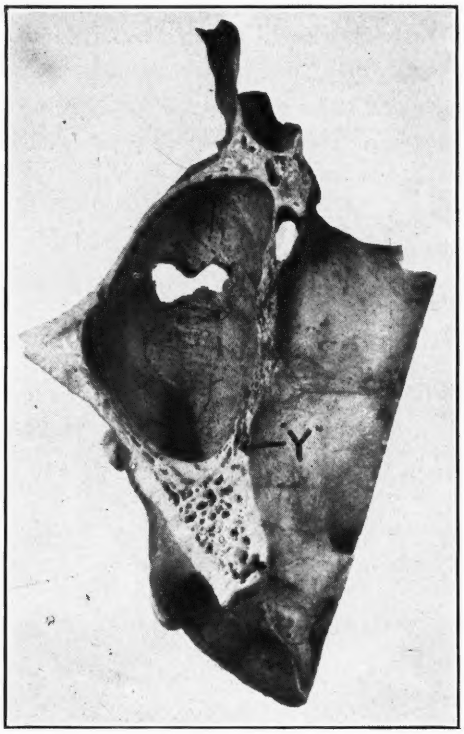


Fig. 21.—Specimen cut on plane of the floor of the nose, showing the nasal fossa extending anterior to the maxillary sinus, thus forming the typical Y.

ridges or crescentic projections of varying sizes and proportions, which occasionally are replaced or followed by septums.

The smaller ridges need not be considered of great consequence, but the large ones that tend to form pockets and recesses of different depths within the cavity may not be disregarded.

The septums sometimes divide the sinus into two cavities (Fig. 19) and, forming at various angles and heights (Fig. 20), are anatomic warnings of which the operator must beware when interpreting roentgenograms of this region and when treating conditions subsequently.

Theory suggests that the larger septums might be a development from the two primary pouches, often discovered in the early stage of life, the in-

tervening wall disappearing in part to leave the large septums we see among adults; but the chief explanation of these osseous projections on the wall of the sinus is probably the unequal resorption of the bone during the development of the sinus, the sinus growing along the line of least resistance.

Very often we find blood vessels within the septums. This may indicate that as the sinus developed and extended the bone containing these vessels offered more resistance to the process of pneumatization.

Unfamiliarity with the anatomic structure of the maxilla has been the cause of irremediable errors because of the failure to recognize minute details of the maxillary sinus and its anatomic variations.

One of the most invariable of the anatomic structures of the maxilla is the inner wall of the maxillary sinus, which is the lateral wall of the nasal fossa. This wall separates the nasal fossa from the sinus; and we discover the floor of the nasal fossa extending far more anteriorly than the floor of the sinus; and, as the inner wall of the nasal fossa extends forward, the anterior wall of the maxillary sinus swings outward laterally, then posteriorly, as the outer wall of the maxillary sinus (Fig. 21).

Fig. 22.—Occlusal roentgenogram of the palate disclosing very clearly a typical Y formed by the nasal fossa extending anterior to the maxillary sinus.

Where the anterior wall of the sinus swings away from the outer wall of the nose, a typical Y is formed. In the crotch of this Y is cancellated bone which supports the premolar, canine and incisor teeth (Fig. 22).

This Y, therefore, becomes the most differential diagnostic landmark in the interpretation of intraoral roentgenograms.

The smaller intraoral films often show the inner wall of the maxillary sinus extending forward as a radiopaque line over the molars and the premolars, and this Y formation may be observed as the line reaches approximately the region of the first premolar.

However, where radiolucent areas here create doubt as to whether it is a normal sinus or a pathologic condition, and the typical Y cannot be detected, we should resort to the occlusal film; for with this film we shall obtain a general view of the entire region and thus will be able to trace the inner wall of the sinus forward, noticing clearly the Y formation where the floor of the nasal fossa extends anterior to the floor of the maxillary sinus.

Once these structures are definitely located, we are in an advantageous position to determine the presence of pathologic conditions; and it is appro-

priate to mention that in the inner wall of the sinus we shall generally discover the lacrimal canal as a radiolucent area, which frequently has been interpreted inaccurately as the posterior palatine foramen or as a pathologic area (Fig. 28*B*).

Fig. 23. Fig. 24. Fig. 25.

Fig. 23.—The patient's head is placed so that the plane of occlusion is parallel to the plane of the floor; the film placed in the mouth posteriorly as far as permitted by the patient; the direct rays are positioned to parallel the sagittal plane.

Fig. 24.—The head maintained in position; the plane of occlusion parallel with the floor, the film is shifted laterally until the inner border of the film is parallel with the sagittal plane; the tube is shifted so that the direct rays parallel the sagittal plane but pass through the infraorbital foramen.

Fig. 25.—The plane of occlusion is parallel with the floor, the film in proper position. The vertical angulation of the tube is adjusted to read between 75 degrees and 85 degrees, depending upon the distal slope of the patient's forehead.

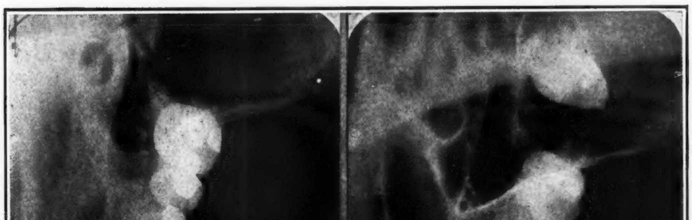


Fig. 26. Fig. 27.

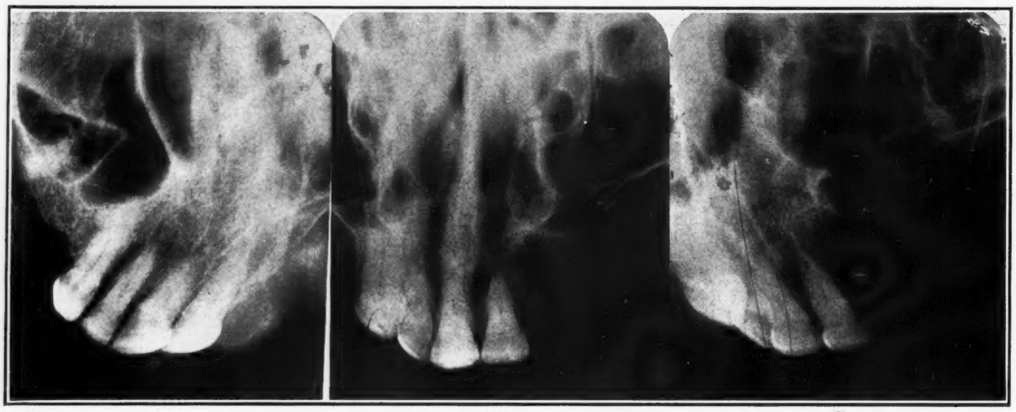
Figs. 26 and 27.—Roentgenograms showing the floor of the maxillary sinus made by following the technic shown in Figs. 23-25.

For examination of the floor of the maxillary sinus, the occlusal film seems the best; and as for the technic, experience has suggested that with the patient in the chair, the plane of occlusion parallel with the room floor, the

film is placed in the mouth parallel with the plane of occlusion, the long axis of the film anterior posteriorly (Fig. 23).

The film is carried laterally until its inner border is on a line with the sagittal plane of the head, and the outer border distends the cheek (Fig. 24). This brings the maxillary sinus directly above the film.

The tube is posed to direct the rays parallel with the sagittal plane, and is then shifted laterally until the central rays will pass through the infraorbital foramen (Fig. 24). The vertical angulation of the tube should be somewhere between 75 degrees and 85 degrees, depending upon the slope of the forehead (Fig. 25), with the direct rays passing through the infraorbital foramen (Figs. 26 and 27). For patients who have decidedly receding foreheads, the vertical angle of the tube may be set at approximately 85 degrees. A slight variation in the technic may be made when it is necessary to view the posterior portion of the floor of the sinus (Fig. 28). This variation is a slight change in the horizontal angulation. The tube is so placed as to allow



A. *B.* *C.*

Fig. 28.—Three roentgenograms of the same patient revealing residual roots in the walls of both the right and left maxillary sinuses. *A* and *C* were taken at an angle of 45 degrees through the canine fossa, which is a slight deviation from the technic shown in Figs. 23-25: the direct rays parallel the sagittal plane, which gives more accurate information of the position of the roots.

the central rays to pass through the canine fossa at a vertical angle of 70 degrees and a horizontal angle of 45 degrees.

NUTRIENT CANALS OF THE MAXILLA

Properly to interpret roentgenograms of the molar and premolar area involving the sinus demands also a knowledge of the blood supply and the nerve supply of the sinuses and teeth in that region.

Traveling practically the same path are the internal maxillary artery and the maxillary branch of the trigeminal nerve, which supply the maxillary teeth and the mucoperiosteal lining of the sinus.

The posterior superior alveolar artery, a branch of the internal maxillary artery, and the posterior superior dental branch of the trigeminal nerve descend upon the tuberosity of the maxilla, where they break up into a plexus (Fig. 29).

Branches of both artery and nerve penetrate through small foramina in the bone, supplying the molars, premolars and the mucous membrane of the sinus. They occur in the outer wall of the sinus in a groove or, more generally, in a rather large, bony canal, which we notice in the roentgenogram as a radiolucent line running anterior posteriorly through the sinus (Fig. 30).

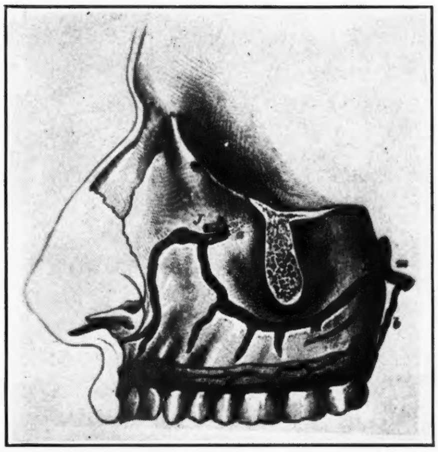


Fig. 29.—The arterial arcade of the maxillary teeth (after Zuckerkandl) ; *M*, the internal maxillary artery; *a*, anterior superior alveolar (dental) artery; *p*, posterior superior alveolar (dental) artery, *b*, buccinator artery.

Fig. 30.—The arterial arcade or arterial loop. Arrows point to the path of the posterior superior alveolar artery which, in this particular case, is rather large, the artery passing forward and anastomosing with the anterior superior alveolar artery. *P*, posterior superior alveolar artery; *L*, loop in region of the infraorbital foramen showing the anastomosis of the posterior superior alveolar artery with the anterior superior alveolar artery.

In some cases this line extends forward in its terminal branches in the nasal fossa near the ala of the nose.

The infraorbital artery starts with the posterior superior alveolar artery, passes through the sphenomaxillary fossa and the sphenomaxillary foramen, and traverses the infraorbital groove and canal with the infraorbital nerve.

We know that the infraorbital nerve gives off two branches, the middle and the anterior superior dental nerves; and the infraorbital artery gives off the anterior superior alveolar artery.

It appears that the anterior superior alveolar artery of the anatomist is more commonly a communicating branch from the infraorbital artery and the posterior superior alveolar artery which loops upward near the infraorbital foramen and receives the communication (Figs. 29 and 30).

This anterior superior alveolar artery, along with the anterior and middle superior dental nerves, passes down the anterior wall of the sinus and supplies the canines, incisors and the mucous membrane of the sinus.

The function of these nerves and arteries is to furnish sensation and to supply nutrition. They follow no definite straight path, but intertwine and bridge across from one canal to another in the bony structures.

Fig. 31. Fig. 32.

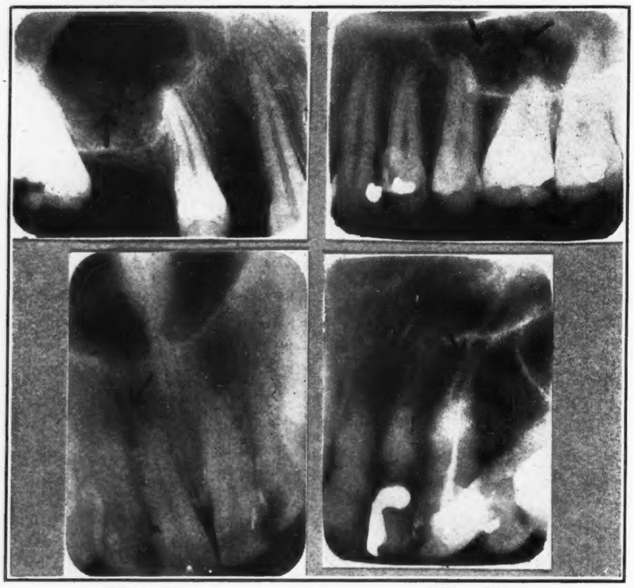


Fig. 33. Fig. 34.

Fig. 31.—A plexus of nutrient canals in the anterior wall of the sinus.

Fig. 32.—A nutrient canal making a definite circle between the second premolar and first molar, which may very readily be mistaken for a pathological area.

Fig. 33.—A nutrient canal passing vertically between the apical third of the roots of the first and second incisors.

Fig. 34.—Nutrient canal directly over the apex of the maxillary canine.

The canals will be observed as radiolucent lines in the walls of the sinus. They are sometimes in direct communication with the apices of the teeth (Fig. 31), forming over the apical region rather well-defined areas (Fig. 32), which should be impressively defined in the mind of the interpreter; for too often have these areas been mistaken for pathologic conditions (Figs. 33 and 34).

NUTRIENT CANALS OF THE MANDIBLE

A thorough study of the internal anatomy of the mandible, especially in reference to its blood supply, discloses more clearly the ramifications of the mandibular artery and its numberless branches traversing the cancellated structure of the mandible (Figs. 35 and 36), many of which disclosures from

a roentgenographic view have been often inaccurately interpreted as signs of periodontal infection, or in case of the edentulous mandible, as a malignancy due to the radiolucent lines traversing the bone.

The mandible holds its place by means of the capsular ligaments and the muscles of mastication, receiving its main blood supply through the mandibular artery. To know the normal anatomy of the mandible comprehends a knowledge of its blood and nerve supply.

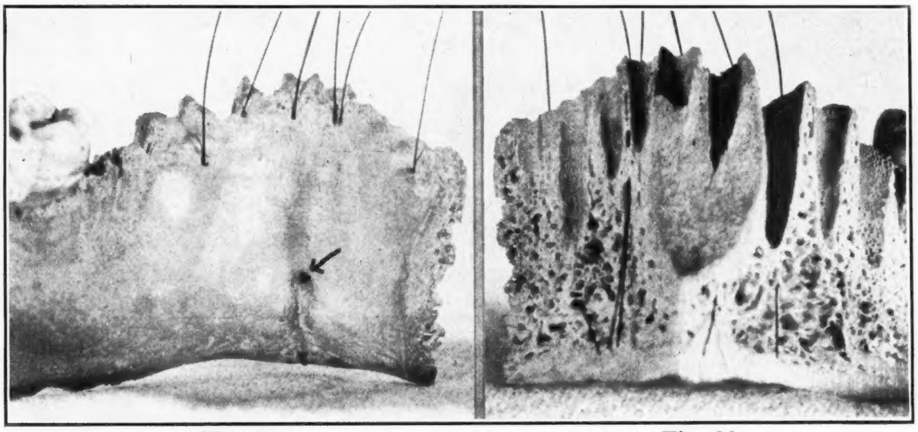


Fig. 35. Fig. 36.

Fig. 35.—Lingual surface of the mandible at the region of the symphysis showing the nutrient foramen, delineated by horsehair passing through them, while below, marked by an arrow, we see the lingual foramen.

Fig. 36.—The labial aspect of the specimen shown in Fig. 35, with the outer plate of the mandible removed, showing the horsehair passing into the cancellated structure by way of the nutrient canals.

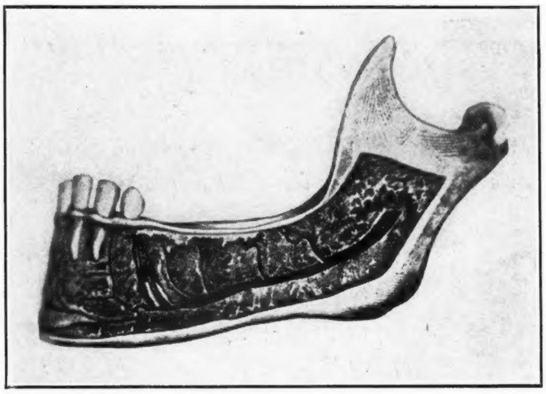


Fig. 37.—Mandible with the mandibular artery and its heavier branches exposed.

Zuckerkandl, in 1891, described the mandibular artery entering the mandibular foramen, passing forward through the mandibular canal and giving off branches which he designated "interalveolar arteries," and emerging at the mental foramen as the "mental artery." Just before issuing from the mental foramen the mandibular artery gives off an incisive branch which passes forward to supply the region forward of the mental foramen (Fig. 37). He further described the blood supply of the teeth and surrounding structures (Fig. 38).

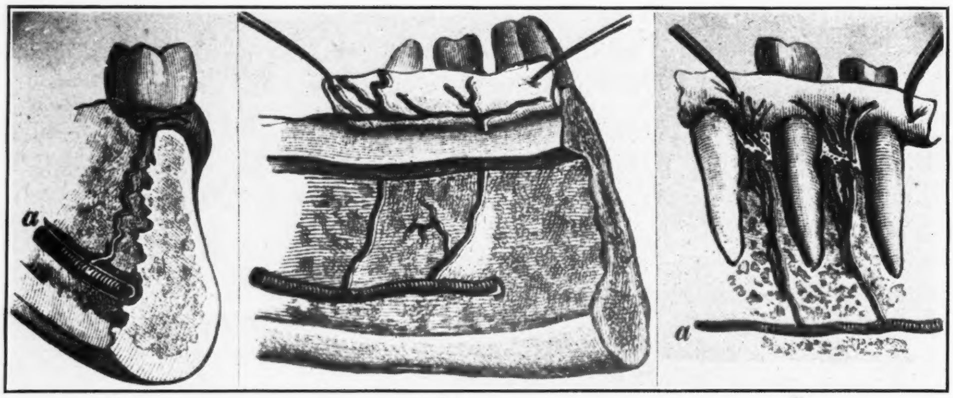


Fig. 38.—*A,* Large interalveolar artery entering the mucous membrane in the septum between the teeth.

B, The interalveolar arteries passing through foramen near the crest of the alveolus and entering the mucous membrane.

C, The interdental artery anastomosing with other vessels in the mucous membrane. (After Zuckerkandl.)

Fig. 39.

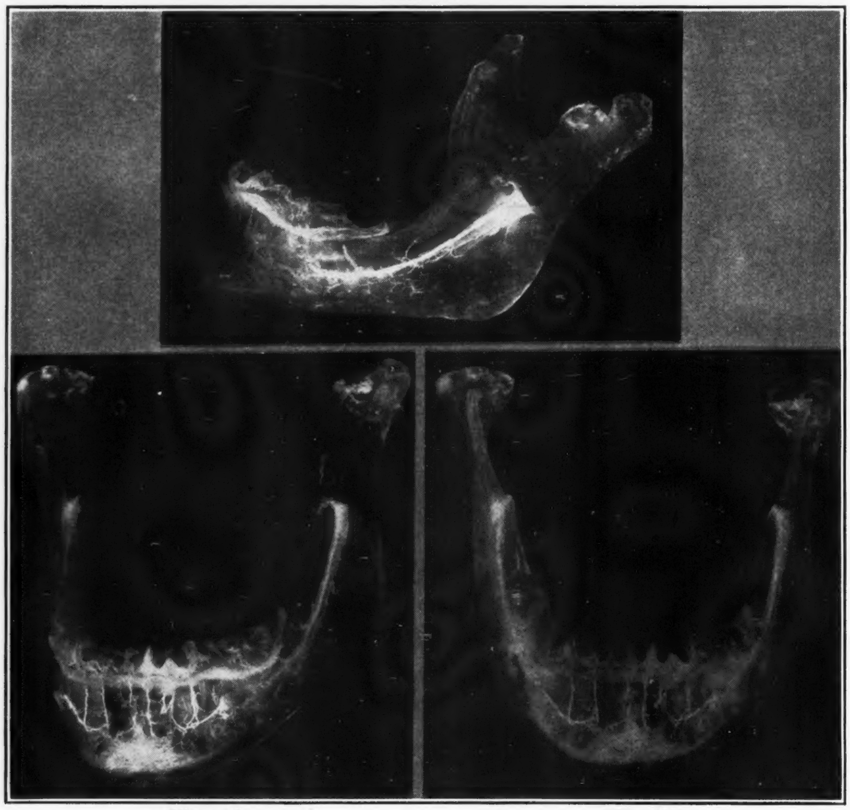


Fig. 40. Fig. 41.

Fig. 39.—An injected and decalcified specimen showing the mandibular artery and its larger branches. The gingival tissue remains on the specimen over the crest of the alveolar ridge showing this tissue to receive its blood supply partly from the mandibular artery. Lateral view of the specimen.

Fig. 40.—A three-quarter view of the specimen. The mandibular artery with its larger branches in the region of the mental foramen showing the many branches extending vertically toward the crest of the ridge.

Fig. 41.—The full anterior view of the same specimen. We see the many branches of the mandibular artery extending upward through the body of the mandible and terminating in the gingiva.

The illustration of the blood supply was ingeniously worked out by Batson, in 1933, showing more clearly than any hitherto published diagram or description the manifold courses followed by the many branches of the mandibular artery, the mental artery leaving the mandible at the mental foramen, the incisive branch running forward in the mandible to the symphysis, giving off branches passing upward and making their exits through the nutrient foramina on the lingual side of the mandible posterior to the incisor teeth. Another branch passes through the lingual foramen, on the lingual side of the mandible in the region of the genial tubercle, and anastomoses with the lingual artery (Figs. 39-41).

The mandibular canal through which the artery passes varies as to its relative position in the structure. In some cases it may be observed traversing a line near the lower border of the mandible; in other cases it appears near the apical regions of the teeth; in some instances it is seen superimposed over the apical third of the roots of the teeth. Thus is knowledge of the exact position of the canal important where removal of teeth is contemplated and particularly when the third molar is involved. It appears on the roentgenogram as a radiolucent area, just as will appear the smaller branches of

Fig. 42. Fig. 43.

Fig. 44. Fig. 45. Fig. 46.

Fig. 42.—Two rather straight nutrient canals appearing as radiolucent lines in the anterior portion of the mandible between the first and second incisors.

Fig. 43.—A number of rather large nutrient canals in region of the symphysis passing upward through the body of the mandible and terminating at the crest of the ridge.

Fig. 44.—The area of the mental foramen, showing radiolucent lines extending upward through the body of the mandible and terminating at the crest of the ridge. These radiolucent lines are the nutrient canals.

Fig. 45.—A number of nutrient canals extending upward through the body of the mandible, bridging across and connecting with one another in the region of the mandibular molars. This particular case had been incorrectly interpreted at a residual root.

Fig. 46.—Nutrient canals in an edentulous mandible. The canals are rather short and terminate directly on the crest of the ridge.

the mandibular canal through which pass the lesser branches of the mandibular artery. They may be noticed in all parts of the mandible, more numerously in the anterior region.

Although for years these smaller canals have been ignored by many dentists, the roentgenologist has brought out their important relation to the entire structural composition of the mandible, and they must be reckoned in considering many phases of operative dentistry. Hirschfeld called them "interdental canals." But as they are not only interdental, but paradental as well, Batson prefers to designate them as "nutrient canals," a term more adequately denoting their functions, for they carry nutrition to the parts by means of the interalveolar arteries.

They appear on the roentgenograms as radiolucent lines passing upward through the body of the mandible, varying in different individuals as to length, width, and degree of radiolucency (Figs. 42-45).

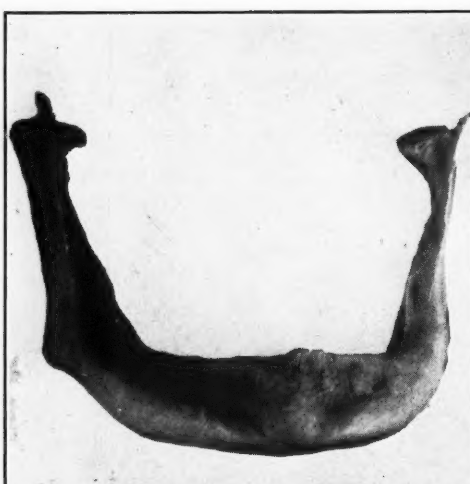


Fig. 47.

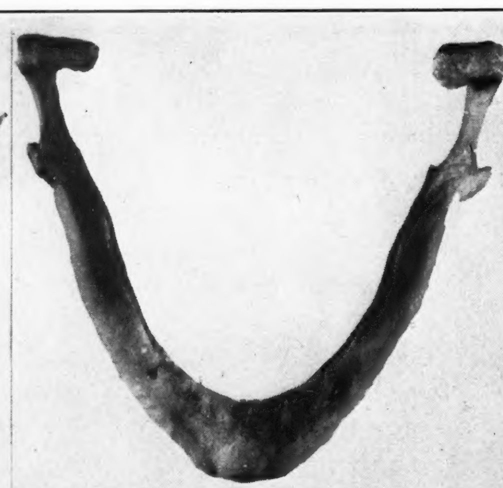


Fig. 48.

Fig. 47.—A mandible, the anterior walls of the nutrient canals completely absorbed, subjecting its nutrient vessels to pressure.

Fig. 48.—A vertical view of the specimen of Fig. 47, showing the nutrient canals to have their terminus on the crest of the ridge. It also shows that an amount of absorption had occurred.

As teeth are lost and resorption of the alveolar process occurs, the nutrient foramen of the mandible approaches the crest of the ridge (Fig. 46). Resorption may be so extensive that the outer wall of the nutrient canals may even be lost, thus inflicting much discomfort from any artificial restorations (Figs. 47 and 48).

In both the maxilla and the mandible these canals are so numerous, and the ability to know and specify exactly which one, or which branch of any one, discloses itself in the roentgenogram, being at times difficult if not almost impossible, we employ for all a term that is comprehensive and sufficiently explanatory of their functions, speaking of them as nutrient canals.

SUMMARY

The roentgenographic examination of the maxillary sinus is rather complicated, this being due to the presence of the upper dental arch. The condi-

tions mentioned are best studied on intraoral films. Cysts and other pathologic lesions may readily be differentiated from changes in the maxillary sinus, and in like manner details of the various extensions of the sinus are best made out. The great detail obtained on intraoral films makes the vascular bony channels which have been variously diagnosed as pathologic changes particularly more significant; likewise knowledge of the vascularity of the mandible is essential due to the varied diagnoses made; for without a thorough knowledge of the normal anatomic structures and their variations, recognition of pathologic lesions is next to impossible.

REFERENCES

Batson, Oscar V.: Original Anatomical Investigations, Department of Anatomy Graduate School of Medicine, University of Pennsylvania.

Batson, O. V., and Ennis, L. M.: A Roentgenological and Anatomical Study of the Maxillary Sinus, Am. J. Roentgenol. 35: 586, 1936.

Ennis, L. M.: Dental Roentgenology, Philadelphia, 1931, Lea & Febiger.

Hirschfeld, Isador: Interdental Canals, J. A. D. A., April, 1927.

Keith, Sir Arthur: The Growth of the Jaws in Health and Disease, Dental Board of the United Kingdom.

Schaeffer, Jacob: Para Nasal Sinuses, Philadelphia, 1920, P. Blakiston's Son & Co.

Zuckerkandl, E.: Der Anatomie der Nasenhole, Leipzig, 1893.

Zuckerkandl, E.: Anatomie der Mundhöle, Wien, 1891.

TORUS PALATINUS

Kurt H. Thoma, D.M.D., Boston, Mass.
Charles A. Brackett Professor of Oral Pathology, Harvard University Dental School

Torus palatinus is a bony elevation in the median line of the vault of the palate. It occurs in a great many forms and variations.

1. The *flat torus* is a broad thickening causing a flat, slightly convex, smooth prominence, symmetrically distributed on both sides of the median raphe, destroying the arched form of the roof of the mouth. It has a wide base and is not pediculated, and may be classified as a hyperostosis of the palatal processes. It is covered by a thin pale mucosa and on account of its hardness often causes difficulty in retaining a full denture (Fig. 6).

2. The *nodular torus* presents small protuberances or bony exostoses, which generally occur bilaterally. When closely united they may form a single swelling (Fig. 1); the lining mucosa, however, often shows the grooves indicating the multiple origin (Fig. 2). If the growth continues, it may progress to the lobular type (Fig. 4).

3. The *spindle-shaped torus* produces a ridge on each side of the median line. A groove indicates its dual bony derivation (Fig. 3). It varies in length and often extends from the papilla palatina to the end of the hard palate, widening in the middle and fading out at the posterior end. It may be the forerunner or early stage of the lobular type.

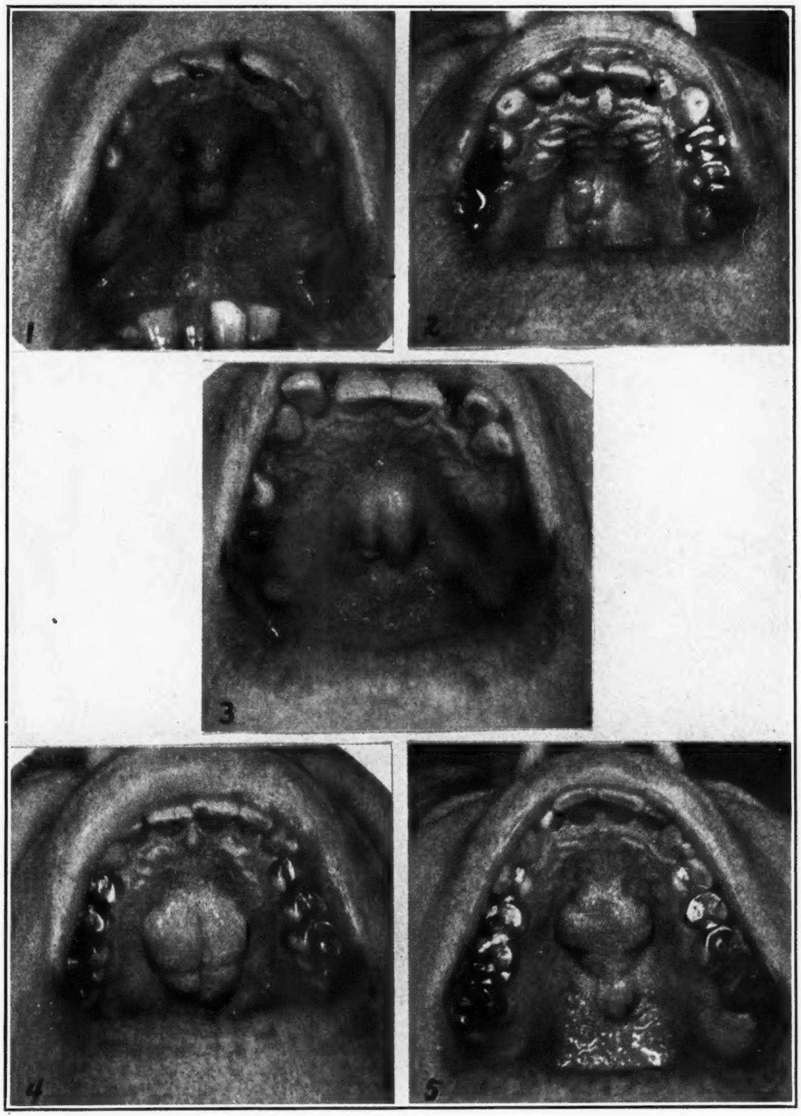
4. The *lobular torus* produces a tumorous overhanging swelling due to continual growth and expansion. Often the entire palate is filled by the mass, even to the extent of coming in contact with the alveolar process laterally (Figs. 4 and 5).

Anthropologic Data.—Although the torus palatinus has not been mentioned in the literature until 1814 when Fox[1] described it as an exostosis of the ossa palati, anthropologists have found evidence of its existence centuries ago. It occurs more frequently in some races than in others. Eskimos are very commonly affected, Stieda[2] reporting an incidence of 60 per cent; but while common they are said to be purely marked. The white races in general show an incidence of 9 to 12 per cent; negroes and Hottentots are least affected.

Pathogenesis.—Chassaignac[3] in 1851 regarded the torus as an early manifestation of tertiary syphilis; he was supported in this view by Huguier but not by Cullerier and Ricord.[4] No doubt he mistook torus for gumma of the palate. Lachmann[5] associated the condition with rachitic palates, and Herbst and Apffelstaedt[6] also expressed the same opinion in 1928. Of interest is an article which appeared in 1893 in a neurologic journal published by Näcke,[7] who includes the torus palatinus as one of the so-called stigmas of degenera-

tion found in criminals and the insane. These observations, however, have not been confirmed by others, nor has pathologic examination disclosed evidence of rickets; at least not in those I have examined.

Hooton[8] in an anthropologic study speaks of the torus as a form of hyperostosis, the result of environmental adaptation which is dependent upon the excessive development of the masticatory apparatus. He believes that the



Figs. 1 and 2.—Torus palatinus, nodular form.
Fig. 3.—Torus palatinus, spindle-shaped type.
Fig. 4.—Torus palatinus, lobular form derived from the nodular type.
Fig. 5.—Torus palatinus, lobular type.

thickening of the palatal vault on each side of the median suture acts as a buttress to resist the pressure exerted toward the center of the palatine region. Matthews[9] made an anatomic study of the structure of the palatal processes and found that tori are small or absent if the bones are dense or massive, but

that they occur frequently in edge-to-edge bite and where there are occlusal facets indicating powerful mastication toward the median line. He interprets a torus therefore as a useful acquired fortification instituted in response to functional demands. The flat torus may indeed be produced in this manner, as it really represents merely a thickening of the bony palate (Fig. 6). The spindle-shaped, nodular, and lobular types, however, are not a hyperostosis but a true exostosis of the palatal processes. In some respects the more pronounced forms, especially the lobular type, present all the features of a benign tumor. Horsley[10] believes the lobular type to be an osteoma, for which opinion he has a good basis on account of the progressive, though slowly growing, nature of the lesion. The development of the tori seems to be caused by a

Fig. 6.

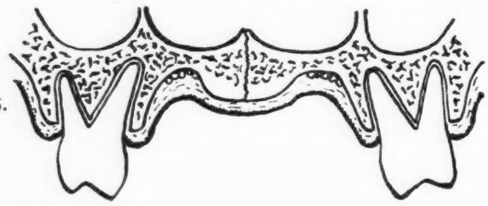


Fig. 7.

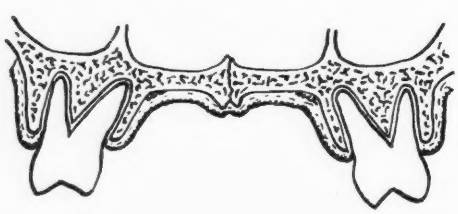


Fig. 8.

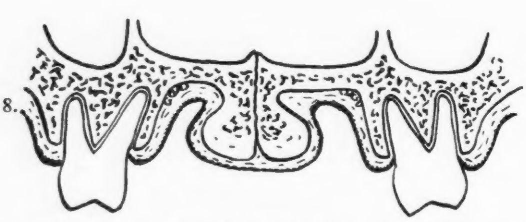


Fig. 6.—Frontal section through palate showing flat torus caused by hyperostosis of palatal process.

Fig. 7.—Frontal section through palate showing early lipping of palatal processes. This type of exostosis gives rise to the spindle-shaped torus.

Fig. 8.—Frontal section through palate showing lobular type torus. The overhanging exostosed bone contains spongiosa.

continuation of growth of the palatal processes which results in a lipping and downgrowth into the palatal vault (Fig. 7). This overgrowth occurs generally on both sides and most frequently in symmetrical manner; even the large lobular tori are made up of two bony parts formed from the edge of each bone at the median line (Fig. 8).

Another theory which has been propounded is to the effect that the osseous centers which form the palatal processes of the superior maxilla and palate bone are capable of producing a certain amount of bone, which, when the dental arch is contracted and narrow, piles up an excess in the median line after the junction is completed.

Clinical Features.—The torus occurs in the adult of either sex, but according to some writers (Koerner[11]) it is twice as frequent among married women than men, and often has a hereditary history. It has been observed, though very rarely, in children. Koerner reports its occurrence in 2.3 per cent of the newborn, but generally it does not begin to attain any well-marked form until after puberty.

It is a characteristic of the true torus that it has an insidious onset dating back as far as the age of eighteen years or younger. It develops so slowly and gradually that many patients are not conscious of its existence even when it attains appreciable proportions. They may discover it accidentally and become greatly alarmed believing that it has formed overnight, while others have their attention called to it only when their dentist is confronted with the construction of a denture. The period of most rapid growth is in the second or third decade.

Fig. 9.—Photomicrograph of a frontal section of torus palatinus showing one half of the bony part. This torus was made up of cortical bone with spongiosa seen only in the pedicle.

The torus palatinus is a benign growth and therefore is of no great significance pathologically. The lobulated form may produce a disturbance of speech or inflammation due to food impaction beneath its sides or between it and the alveolus. When the need arises for the construction of a partial, and especially a full, denture, its presence causes considerable difficulty not only on account of the mechanical aspect but also on account of the thinner mucosa

overlying it. It is true that dentures can be constructed in spite of the encumbrance and are worn by patients without complaint, although they often have poor adhesive property. Soon they will ride on the hard ridge and will rock from side to side, and in some cases will cause inflammation through irritation. The enlargement of the swelling makes it ultimately impossible to wear the plate at all. While the flat and spindle-shaped torus can generally be taken care of by a relief in the denture, surgical removal of the nodular or lobular forms should be advised when the mouth is prepared for a denture. Both these types lend themselves well to operation.

Pathologic Findings.—The flat torus may represent only a thickening of the bony palate toward the median line. This type has been used as an illustration by Colyer and Sprawson.[12] The hyperostosis may cause a thickening of the cortex due to periosteal new formation or the cortex may be normal but the bulging due to increase in the amount of spongiosa (Fig. 6). The full

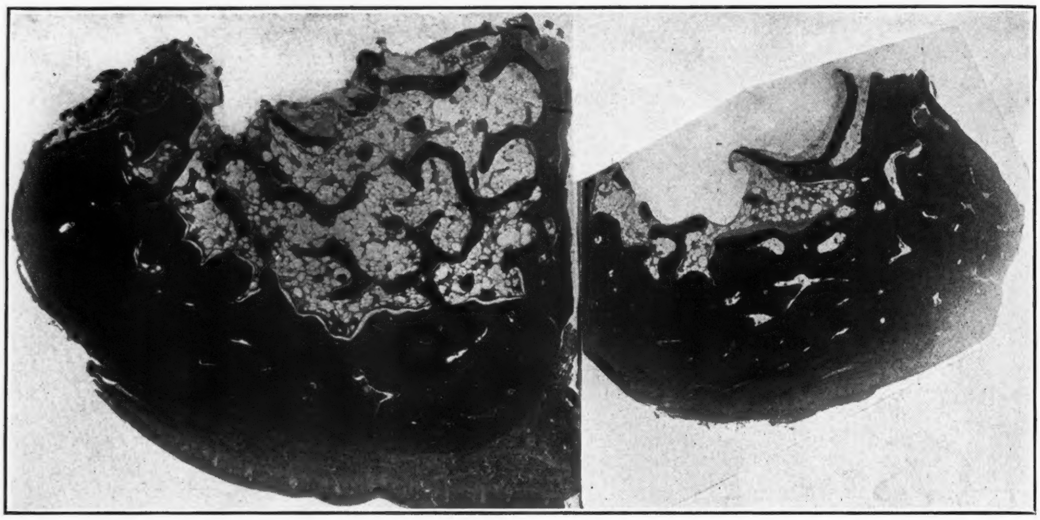


Fig. 10.—Photomicrograph of a frontal section of a lobular torus palatinus showing the two bony parts. The larger has attached to it part of the mucosa. Both parts show a thick outer cortex, a thin median lamella lined with periosteum, and a wide-meshed spongiosa containing fatty marrow.

extent of the torus may not be evidenced when examining the mouth because laterally the mucosa becomes padded by the underlying mucous glands and areolar tissue.

The spindle-shaped torus often forms a spine or crest (cresta palatina) of cortical bone, the two parts being in close contact and tapering to an edge. In other cases two distinct ridges form due to separation in the median line (Fig. 7). These ridges may be cortical at first, but, when through development they tend toward the lobular shape, a spongiosa may form in the center.

The nodular type may be made up of solid bone when small, but contains also a spongiosa when of larger proportions. It may be that separate nodules as shown in Fig. 2 will later fuse to a single torus as shown in Fig. 4, which still shows grooves demarking its origin from four separate centers.

The lobular form therefore seems to take its origin in the spindle-shaped or the nodular torus. At first it may present almost only cortical bone, though

a developing spongiosa can generally be seen to extend through the pedicle into the inner part (Fig. 9). When more fully developed to the overhanging type the spongiosa is well marked containing fatty marrow. Thick cortical bone is formed on the surface exposed to the mucosa, but only thin lamina at the median side where it is separated by fibrous connective tissue from its mate (Fig. 10).

Differential diagnosis presents no great difficulties. Fibroma which may occur at the same site and age is soft, flexible and movable. So are hypertrophy of the palatal glands, gumma, adenoma, and mixed tumor; the latter forms a semiglobular swelling. Cysts of the papilla palatina and the incisive canal are fluctuant and located on the anterior part of the palate; on puncture they yield a yellow fluid which can be aspirated with a syringe.

Roentgen Examination.—Tori generally are very radiopaque and are often the cause of dense shadows obscuring the picture of the teeth. They can be shown in extraoral exposures of the side of the face when they appear as dense shadows over the teeth and the maxillary sinus. Often they appear completely dense; at other times the spongiosa is visible in the center. (See Thoma, *Clinical Pathology of the Jaws,* Figs. 298 and 299b.)

Technic of Operation.—The flat and spindle-shaped torus rarely requires operative interference. If on account of its shape and size, however, there are difficulties in constructing and retaining a denture, it may be removed surgically. Dorrance[13] has illustrated an operation which is suitable for this type. The incision is made along the median line of the palate with a deltoid branching at both ends of the torus. The mucosa is detached and retracted when the torus can be removed with chisel and bone files. After the desired amount of bone is removed, which generally results in the exposure of the spongiosa, the mucoperiosteum is trimmed and replaced, and held by silk sutures.

The nodular form is treated in a similar fashion, except that on account of the small size of the nodules a single longitudinal incision over each nodule is generally the best method to obtain access to remove it.

The Lobular Torus.—The lobular torus like the flat and nodular ones may be removed with either local or general anesthesia. If local anesthesia is chosen, injection over the incisive and both anterior palatine foramina gives the best results. Strict asepsis should be observed, or infection of the flaps will produce undesirable scar formation. The entire palate, gingiva, and teeth are painted with metaphen.

I use two curved incisions carried down to the bone over the dorsum of the torus extending anteroposteriorly, one to the left and the other to the right so that an elliptic piece of mucosa is cut out (Fig. 11). This reduces the size of the flap and gives better access to the pedicle of the torus, the remaining part of the mucosa not being needed to cover the wound.

The mucoperiosteal flap on the side giving best access to the pedicle is then freed with a periosteal elevator. The bony torus is exposed on the side down to and including the normal palate almost as far as the alveolar process. Care must be exercised so that the mucosa is not torn at right angles when doing this, particularly on the posterior end. Here the flap need not be ex-

tended far laterally; only the torus itself need be bared. If there is bleeding from the anterior palatine artery, the artery is grasped with a curved hemostat and tied. A retractor is inserted next, or two stitches may be taken with silk in the mucosa and attached between the teeth or to the alveolar gingiva to pull the mucosa back and give access needed to drill a few holes through the pedicle from the side; a bayonet-shaped, long shank bur is used. The retractor

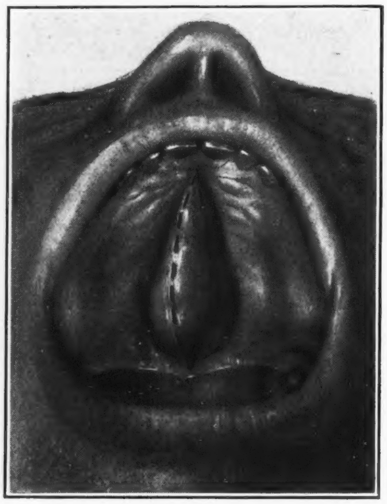


Fig. 11.—Operation for excision of lobular torus; incision.

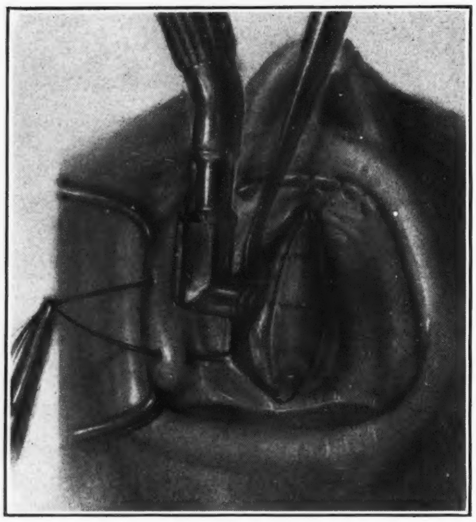


Fig. 12.—Operation for excision of lobular torus; mucoperiosteal flap retracted on one side to allow the drilling of holes through the pedicle.

must also serve to protect the soft tissue from the drill (Fig. 12). The mucoperiosteal flap is then detached on the other side and retracted, and the torus is then separated from its base with a concave, flat chisel by a succession of carefully measured blows (Fig. 13). Generally the two bony parts of the torus come apart during this procedure unless the remaining mucosa holds them together. Instead of this technic some surgeons prefer to remove the

torus without drilling holes with either the chisel or rongeurs. The first method has the advantage of safety, because the palatal processes are sometimes thin; and it also preserves the excised specimen so that it can be studied microscopically.

After excision of the torus there may be bleeding from the bone, but this generally stops if pressure is applied with a sterile sponge or a sponge with

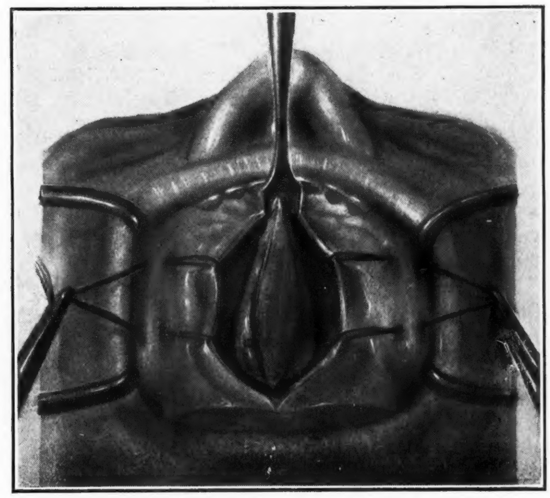


Fig. 13.—Operation for excision of lobular torus; chisel is used to cut through pedicle in anteroposterior direction.

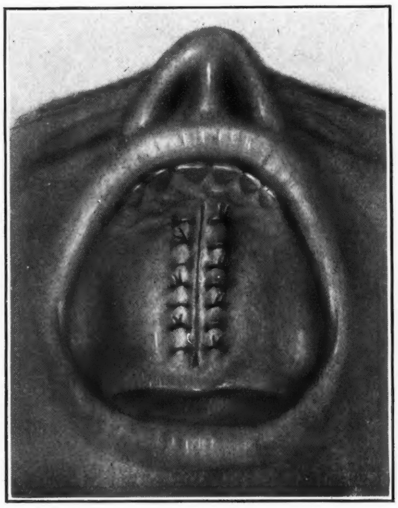


Fig. 14.—Operation for excising lobular torus; after trimming the flaps interrupted mattress sutures are used to close the wound.

adrenalin. With a large round "vulcanite bur" or a curved file, all projecting rough edges are removed. The débris is taken up with sterile sponges, and after careful inspection the flaps are allowed to fall back over the bone. These are now carefully trimmed to approximate the median line, by the use of either scissors or the knife, a process which requires considerable care and skill. The edges are then held together with interrupted vertical mattress sutures (Fig. 14). Black silk may be used for the purpose. No denture must be worn

until healing is completed. Most of the sutures are removed the fourth day; two may be left for a week. The mouth should be sprayed daily and the wound painted with metaphen. A mouth wash should be prescribed. If the operation has been carefully carried out, recovery should be uneventful.

REFERENCES

1. Fox, J.: The Natural History and Diseases of the Teeth, p. 135, London, 1814.
2. Stieda, L.: Der Gaumenwulst (Torus Palatinus), Inter. Beiträge z. Wissensch. Medicin Festesch. **1**: 145, 1891.
3. Chassaignac: Bull. Soc. de Chir. de Paris **8**: 138, 1851-52.
4. Cullerier and Ricord: Bull. Soc. de Chir. de Paris **8**: 306, 1857-58.
5. Lachmann, H.: Torus Palatinus bei Degenerierten, Ztschr. f. d. ges. Neurol. u. Phychiat. **111**: 616, 1927.
6. Herbst, E., and Apffelstaedt: Atlas und Grundriss der Missbilungen der Kiefer und Zaehne, Muenchen, p. 49, 1928.
7. Näcke, P.: Der Gaumenwulst (Torus Palatinus)—ein neues Degenerationszeichen, Neurologisches Centralblatt **13**: 402, 1893.
8. Hooton, E. A.: On Certain Eskimoid Characters in Icelandic Skulls, Am. J. Physical Anthro. **1**: 53, 1918.
9. Matthews, G. P.: Mandibular and Palatine Tori and Their Etiology, J. Dent. Res. **13**: 245, 1933.
10. Horsley, J. S.: Osteoma of the Hard Palate, S. Clin. North America **2**: 1241, 1922.
11. Koerner, O.: Der Torus Palatinus, Ztschr. f. Ohrenh. u. f. d. Krankh. d. Luft. **61**: 24, 1910.
12. Colyer, J. F., and Sprawson, E.: Dental Surgery and Pathology, London, 1931, Longmans, Green & Co., p. 822.
13. Dorrance, G. M.: Torus Palatinus, Dent. Cosmos **71**: 275, 1929.

47 Bay State Road

PREVENTION AND TREATMENT OF BLEEDING IN ORAL SURGERY

LEO WINTER, D.D.S., M.D., NEW YORK, N. Y.

HEMORRHAGE IN SURGERY

IN CARRYING out oral surgical operations, both the operator and the patient proceed on the assumption that the consequences or end-results will be satisfactory. They do not anticipate that the complications or by-products will be graver than the operation itself. Yet we find this to be the case with bleeding in oral surgical operations. The importance of controlling bleeding in minor oral surgery operations was pointed out in a study of two hundred coagulation and bleeding tests conducted at the New York University College of Dentistry.[1] As pointed out there, there is no scientific classification of the different degrees of bleeding, and we cannot always tell the extent of its danger. It should also be borne in mind that the loss of any given amount of blood may have a different physiologic effect on different patients. Various methods in the control of tonsil and adenoid bleeding[2] and nasal bleeding are constantly sought. The oral surgeon's objective, like that of the general surgeon, is becoming more and more preventive in character. The trend in oral surgery is like that of general surgery, stressed by Dr. J. Tate Mason[3] in his recent annual address before the American Medical Association.

"With our increasing knowledge and our improvement in technic, we are now in a transition era that is a transition from surgery as a mechanical correction of disorders of the body to surgery aimed at a restoration of normal bodily function. The surgeon of today is concerned not only with the eradication of the morbid process but also with the restoration of the body to the physiologic normal."

THE FATAL OUTCOME OF DENTAL HEMORRHAGE

Dental patients as a rule do not inform us that they are bleeders. In the recital of their histories hemophiliac patients do not generally acquaint us with the fact that several members of their family died of hemorrhage. The slightest injury suffices to occasion fatal bleeding in patients of this kind. For this reason all operative procedures on such patients must be limited as far as possible, and carried out only when life is at stake. Every case of hemorrhage must be regarded as potentially serious. One can never tell definitely, without the necessary preliminary tests, whether the patient has only a marked tendency to bleed or is a true hemophiliac. Very often patients state specifically that they bleed easily. Dental surgeons, however, do not commonly view such information as significant, suggestive of the need for preventive measures.

In this connection the history of a patient as reported by Moral[4] is of interest. The case is that of a twenty-six-year-old clerk who had recovered from

an attack of typhoid fever at the age of twenty years, and at twenty-two had been treated for ten weeks for hemorrhages of the stomach. He said that he had repeatedly observed severe bleeding of the gums. The patient observed a pronounced swelling in the lower jaw, coupled with pain in or about a tooth. He consulted a dentist, informing him that he was a bleeder, information which his physician asked him to give whenever he consulted a physician or a dentist. Three days later, the dentist removed the tooth, the hemorrhage having continued even though ferric chloride dressings had been applied—a remedy that should not have been used under any circumstances—and the patient was referred to a hospital for further treatment. The man appeared at the hospital, pale and undernourished. Blood flowed continuously from the empty alveolus. A tampon made of iodoform gauze was tried unsuccessfully. This was followed by applications of coagulin, both liquid and solid; then penghawar djambi—all without result. On the following morning the patient received, intramuscularly, 40 c.c. of sterile solution of gelatin; a little later 10 c.c. of a solution of sodium chloride intravenously. Notwithstanding these injections and the application of firmly implanted tampons, the bleeding did not cease. At 4 P.M. of that day, the patient's pulse was 124, and there was increasing pallor. Under ethyl chloride anesthesia the thermocautery was applied. This was successful with the exception of an oozing from a very small point. The following day, the third in the hospital, the bleeding had been practically arrested, the patient had revived, the pulse rate fell to 108. This condition lasted until the seventh day, but on the eighth day the bleeding increased again, and application of the thermocautery proved effective once more. At intervals, however, the bleeding alternately increased and decreased, the tampon being continuously employed and the patient enjoined to refrain from every unnecessary movement. Gelatin solution was repeatedly injected and local coagulin and suprarenin were applied. Oil of turpentine was employed on the twelfth day. Notwithstanding employment of the above and all other available known remedies, the bleeding continued slowly but persistently; the patient was almost white, and the pulse rate rose to 116. After a few days the pulse increased to 138 and the patient's pallor became deathlike. On the seventeenth day vomiting began with the pulse rate at 120; toward evening the pulse rate increased. The patient was semiconscious during the night of the seventeenth day to the eighteenth day, when death occurred after complete exsanguination and visible cerebral convulsions. Similar cases have been reported by Quinlan and others.

CLASSIFICATION OF HEMORRHAGE

Hemorrhage following oral surgical procedures should be considered a serious complication and calls for prompt treatment. Hemorrhage may occur in patients who are not predisposed to hemorrhagic diathesis; as in anemia, jaundice, etc.

Hemorrhage is generally divided into three stages, namely, primary, intermediate, and secondary. Primary hemorrhage is that which occurs at the time

of the operation. Intermediate hemorrhage refers to bleeding that recurs within twenty hours of the operation. Secondary hemorrhage indicates bleeding that takes place after a lapse of twenty-four hours. In several cases, treated at the Oral Surgery Clinic of New York University, secondary hemorrhage has occurred five to seven days following the operation.

COAGULATION OF BLOOD

The advances made in oral surgery make it necessary for the operator to employ all available means at his disposal for the safety of the patients. The time has passed when the exodontist felt that teeth should be extracted irrespective of the patient's general health. The employment of suitable tests to determine the coagulation of blood is considered an essential diagnostic procedure when indicated. In the past, the testing of the blood to determine coagulation time and bleeding time was a comparatively difficult technic that required test tubes, suction pumps, a well-equipped laboratory, etc. The method here presented enables every operator, in his own office, and in a very few minutes, to verify or remove his own suspicion or the patient's belief regarding possible hemorrhage. While the method is not perfect, at least it gives an index that serves as a guide in determining whether or not premedication is necessary for a given patient. It also serves as a guide to postoperative treatment.

Coagulation is the main protective mechanism that makes hemostasis naturally possible.[5] When we speak of satisfactory coagulation, we imply that a sufficiently resistant clot has formed over bleeding vessels within a reasonable period of time.

THEORIES OF COAGULATION

Many theories have been advanced to explain the coagulation mechanism. These theories aim to interpret the various reactions whereby the different substances in the blood ultimately produce fibrin. The most important theories are those by Howell, Morawitz, Bordet and Mill.

Coagulation, according to Howell's theory, is determined by five factors: (a) prothrombin, activated by calcium salts (b) becomes thrombin, which acts on fibrinogen (c) to form fibrin. Prothrombin, which is held in combination with antithrombin (d) ordinarily while the blood is in circulation, coming in contact with thromboplastin—thrombokinase—(e), found largely in the tissue juices or being partially dependent on the number of disintegrated blood platelets, is allowed to act, due to neutralization of the antithrombin by the thromboplastin.

In clinical work, coagulation time with determinations of the character of the clot, bleeding time, prothrombin time, number of blood platelets, and calcium determination, can be made. As a possible index to detection of postoperative bleeding or hemorrhage, where dangerous capillary oozing is likely, the relative value of these procedures is roughly in this order:

(a), (b), (c) Coagulation time, bleeding time, and prothrombin time are valuable. Relatively, prothrombin time and coagulation time tend to agree.

(d) Blood platelet count—valuable so far as purpura may be diagnosed.

(e) Determination of blood calcium content is of questionable value.

Our study embodied determinations of coagulation time and bleeding time only.

COAGULATION TIME

For the determination of coagulation time there are several available methods of which the most accurate, tending to obviate some of the objectionable features in skin puncture methods (Howell, Lee and White, King and Murray, etc.), are those employing venipuncture. On the other hand, in the type of case upon which this study was made, the convenience of a skin puncture method or some modification, such as the capillary tube, Biffi-Brook's, Boggs', Duke's, or Goeckel's procedure, makes it more desirable. It must be constantly kept in mind, however, that with these methods there are certain dangers of serious error, which careful precaution alone can prevent. Goeckel's method was used. The end of a finger is thoroughly cleansed with alcohol, and punctured with a blood lancet of the type that operates by the release of a spring, and the time of the appearance of blood is noted. A medium size drop of blood is immediately placed in the center of each of the two concavities in a hollow ground slide, which are slightly deeper than those used in microscopic agglutination tests, and a second similar slide is put over it. On tilting the slides gently, about every thirty seconds after the third minute, the noncoagulated blood tends to gravitate toward the lighter area. As coagulation becomes complete, the drop solidifies and at times serum exudes from it. When coagulation is complete, the drop can be quickly exposed and the point of a needle touched to the coagulum, which will then show shreds of fibrin. Final reading is made at this time, which normally is about five minutes after withdrawal of the blood.

Attention should be drawn to the following facts relative to this method:

(a) In selecting a part of a finger for puncture, one should avoid areas in which the epidermis has been unduly thickened.

(b) In order that the flow of blood may be comparatively free, the puncture should be deep (about 2 to 3 mm.), thereby avoiding pressure on the part and the introduction of thrombokinase or thromboplastin from the tissue juices, which would tend to make the coagulation time artificially short.

(c) The slides should be at body temperature, thoroughly clean, free from grease, and dry.

(d) When one slide overlays the other slide, the concavities containing blood should be comparatively air-tight.

(e) The slides should not be allowed to slip on their surfaces of contact, otherwise the drop of blood would be smeared and the test vitiated.

(f) Unnecessary exposure of the blood to the air should be avoided.

(g) The method is simple, economical, and relatively accurate.

(h) Each sample of blood should be tested in duplicate.

BLEEDING TIME

Bleeding time is the time required for a small cut to stop bleeding. Duke's method was employed. After the part selected, commonly the tip of a finger or the lobe of the ear, is thoroughly cleansed with alcohol and the part is dry, puncture which should be slightly deeper than the one used for an ordinary blood count is made with a lancet or scalpel, and the time is noted. At half-minute intervals, the wound is blotted with a piece of absorbent paper. Ordinarily bleeding ceases in from one to three minutes, but continuance from about eight minutes may be normal. While the conditions of the punctures should be as nearly uniform as possible (thickness of skin, form and depth of puncture), even deep punctures in normal individuals cease bleeding quickly. Further, in the blotting process, care should be taken to avoid dislodgment of the clot or squeezing of the punctured part, because the bleeding time would thus tend to be prolonged. One puncture suffices for determinations of both coagulation time and bleeding time.

THE COAGULATION TEST AS AN AID IN DIAGNOSIS

A series of tests made at the New York University College of Dentistry shows the average coagulation time to be four minutes and fifty-four seconds, and the bleeding time to be two minutes and thirty-five seconds. Normal figures have been recorded by various authorities as four to ten minutes and one to five minutes respectively. A variation of a few minutes, however, is of practically no significance. When abnormal variations occur, ordinarily the tests can be easily checked; and, if "times" are unusually prolonged, treatment is indicated. So far as we know, none of the patients on whom these coagulation and bleeding tests were made showed postoperative hemorrhage. Todd and others agree that tests of coagulation and bleeding times are indicated in all operations in which oozing is liable to arise, as in jaundiced patients, and those who have had tonsillectomies. We venture to add that such tests should be routinely employed in oral work. The injection of suprarenin may play a part in the prevention of postoperative hemorrhage.

While true hemophilia is not common, is inherited, and is confined to males, cases of adventitious bleeding, due to other causes, occur occasionally. Therefore, while it may be necessary to make thousands of tests before one of these cases is found, it is well worth the effort if the consequences of unexpected hemorrhage can be forestalled or avoided.

In cases of prolonged coagulation time or bleeding time, the necessary premedication will depend upon their variation from the normal and the clinical diagnoses of the respective cases. Thus, it may be calcium chloride, 10 to 20 grains, three times a day, taken three days prior to operation; sodium citrate, etc. In keeping with the work of Partsch, if an operation on a bleeder cannot be avoided, it is advisable, twenty-four hours before the operation, to inject 20 c.c. of horse serum or diphtheria antitoxin in the skin of the back. In hemorrhagic diatheses blood transfusions, x-ray treatment of the bone marrow, and, for severe cases, extirpation of the spleen, may be considered.

THE TREATMENT OF HEMORRHAGE

The treatment of primary hemorrhage is not of serious importance. If it is at all persistent, pressure should be applied by means of sterile gauze, sponges, or pads. If the bleeding is from the alveolus, this should be packed with iodoform gauze (5 per cent). Frequent rinsing of the mouth does not diminish bleeding but tends rather to stimulate it. Patients should not be dismissed until all bleeding has ceased, and before leaving the office they should be instructed in the emergency treatment to be instituted until medical aid arrives. It is a good procedure to provide the patient with some gauze sponges, which can be utilized, as directed, should an emergency arise while he is in transit.

Intermediate and secondary hemorrhages are more serious and require heroic treatment. In our experience, in oral surgery these conditions always set in at night. When these cases are first seen, the patient is usually unable to talk because of the presence in the mouth of large masses of coagulated blood. Relatives or friends who may accompany the patient generally give a history of refusals of various dental surgeons to offer treatment; some patients even make the statement that entrance into offices was refused by attendants. The dental surgeon may fear, in such instances, that the patient is a hemophiliac and, not being responsible for the operation, does not desire to be involved in the consequences. The fact remains, however, that we are called upon to treat such cases; and, as they are the results of our own operations, we should be more competent to deal with them than the average medical practitioner into whose hands they frequently pass.

TREATMENT OF DENTAL HEMORRHAGE WITH SNAKE VENOM

Scientifically, females are not true hemophiliacs; however from a practical standpoint the profuse, persistent, capillary oozing which takes place in females at times very closely resembles the nature of bleeding of hemophiliacs. It, therefore, is important that we do not dismiss the factor of the inability of the female sex to bleed to an alarming extent, and it behooves the operator therefore to take the necessary precautions, preoperative as well as postoperative, in cases of females who give a history of severe bleeding following operations.

The use of snake venom in our experience has not been of any practical value in the control of bleeding in hemophiliacs. It is possible that the small number of cases upon which the snake venom was tried were not suitable, and as a result our statement to the effect of its failure to aid can be accepted only as our own experience and not in any way to deter from attempts which are being made in the experimentation in the use of this drug. The procedure in Bellevue Hospital in cases of known hemophiliacs, even where the operation consists of the extraction of one tooth, is to hospitalize the patient, give him a transfusion and on the following day remove the tooth and pack the socket immediately, applying pressure on top of the dressing with a small splint of modeling composition on one side of the jaw (the affected side) which allows space for the intake of food on the opposite side and application of Barton

bandage to keep the necessary pressure. Fluids are forced, cold compresses applied externally, every effort being made to move the patient as little as possible. No attempt is made to disturb the dressing until a minimum of seventy-two hours is passed; then the uppermost part of the packing is removed. If there is no bleeding, pressure is again applied; and the following day or forty-eight hours later another portion of the packing is removed until the entire portion comes out, which may be over a period of seven to ten days. Should bleeding begin again, during the time a small portion of the packing is removed, it is repacked, and sterner measures toward the control of bleeding are instituted.

In 1935 MacFarlane reported satisfactory results of the action of snake venom on the coagulation time of hemophiliac blood. Cambrook[6] used snake venom in the treatment of over fifty cases of dental hemorrhage, including several hemophiliacs, with apparently satisfactory results. Of the entire series of cases studied, Cambrook reports only two failures. In one case in which two teeth were extracted, the venom failed to arrest the hemorrhage. It was later disclosed that the patient suffered from subclinical scurvy. The other case was a failure because there was a tear in the floor of the mouth. The hemorrhage stopped of its own accord.

The venom of Russel's viper has a remarkable power to diminish the time of coagulation of blood, hemophiliac and normal. This striking action of the venom is not well understood; it is known to act as a form of thrombokinase. The clots are tought and elastic. They differ markedly from the feeble, friable clots of hemophiliac blood. The fibrin separates and more quickly, giving a very short fibrin time. Studies of the effect of temperature on coagulation time have shown that it is desirable to use the venom hot.

To double the coagulation time, it was necessary to dilute the venom ten times. It was found that venom in 1:10,000 dilution coagulates its volume of hemophiliac blood in less than twenty seconds. In this strength, the venom is neither irritant nor toxic and does not interfere with healing. Sterility of the solution is necessary since it is applied to raw wounds. Sterilization had to be accomplished by filtration, as it was found that the coagulant was destroyed by heat. The original method of putting up the venom in solution was abandoned; since it was unstable unless kept in a refrigerator. The venom is evaporated with saline in ampules under pressure. The addition of water gives a 1:10,000 solution in normal saline. It is now used in this form.

The technic of application is comparatively simple. A case history should always be taken, followed by a blood examination when indicated. The tooth or teeth are removed with a local anesthetic. Local damage to the tissues may be avoided by the use of block anesthesia. Right after the extraction a cotton-wool plug, soaked in hot venom, is pressed against the socket. The pressure should not be directed toward the center of the socket, but only to the edges of the socket. In this way the plug assumes a mushroom-shaped form which acts like a mechanical device in obstructing the flow of blood. The venom when squeezed out from the plug mixes with the blood and forms

a tough firm clot. It is advisable to use gauze or cotton roll and to have the patient bite on it. The plug is left in position until it falls out. This is repeated until the hemorrhage is under full control.

The general directions to be given to the patient, though apparently trivial, are most important and should never be forgotten. He should be advised to go home very quietly, to avoid all forms of excitement, to assume the sitting position during the day, and to use a high pillow at night. The patient should be fed through a bent tube, and all fluids should be given cold.

REFERENCES

1. Winter, Leo, and Darlington, Charles G.: The Control of Bleeding in Minor Oral Surgery Operations, J. Dent. Res. **6**: 13, 1924.
2. Pearlman, Louis M.: Control of Tonsil and Adenoid Bleeding, M. Rec. **143**: 208, 1936.
3. Mason, Tate J.: Modern Trends in Surgery, J. A. M. A. **106**: 1695, 1936.
4. Moral, Hans: Einfuhrung in die Klinik der Zahn und Mund Krankheiten, Leipsic, 1922, F. C. W. Vogel.
5. Wiggers, Carl J.: Physiology in Health and Disease, Philadelphia, p. 252, 1934, Lea & Febiger.
6. Cambrook, J. Draper: Snake Venom and Its Use in Dental Hemorrhage, Proc. Roy. Soc. Med., Section on Odontology **29**: 281, 1936.

Department of Orthodontic Abstracts and Reviews

Edited by
Dr. Egon Neustadt, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. Egon Neustadt, 133 East Fifty-Eighth Street, New York City.

The Etiologic Factor of Impaired Mastication Upon Gastrointestinal Diseases (Die Rolle der Pathologie des Kauens in der Klinik der Magendarmkrankheiten). By S. E. Gelman, Ztschr. f. Stomatol. **34:** 34, 1936.

A good condition of the masticatory apparatus does not always guarantee sufficient trituration of food; on the other hand, a mutilated mouth may often provide entirely satisfactory comminution due to changes in food selection and chewing habits. Contrary to common belief, the assimilation of food suffers no serious setback through deficiencies of the masticatory apparatus. What, then, is the rôle which impaired mastication plays in the etiology of gastrointestinal diseases? The following possibilities should be considered: (1) mutilation of the dental arches; (2) superficial chewing; (3) fast eating; (4) irregular meals.

STATISTICS

Two hundred people of different ages and occupations were examined. There were 77.5 per cent men, the majority of them between the ages of thirty and forty years. At the first examination, the patients were divided into the following groups: gastritis 135; gastric ulcers 49; duodenal ulcer 10; colitis 6. At their last examinations, these figures were modified as follows: gastritis 73; gastric ulcers 81; duodenal ulcer 21; colitis 18; cancer 7.

The condition of the teeth at the beginning of the disease was: excellent 49 per cent; good (2 to 4 teeth missing) 24 per cent; fair (6 to 8 teeth missing) 11 per cent; poor (10 to 16 teeth missing) 9 per cent; very poor (18 to 28 teeth missing) 7 per cent.

The condition at the time of the examination was: excellent 19 per cent; good 26 per cent; fair 22 per cent; poor 17 per cent; very poor 16 per cent. Of the whole number of patients, 26 used removable plates. The functional evaluation of their dental condition was:

MASTICATING POSSIBILITY	MASTICATING EFFICIENCY
90 to 100%—110 persons	90 to 100%—126 persons
75 to 89%— 48 persons	75 to 89%— 44 persons
50 to 74%— 20 persons	50 to 74%— 18 persons
25 to 49%— 14 persons	25 to 49%— 10 persons
0 to 24%— 8 persons	0 to 24%— 2 persons

Only 35 per cent chewed thoroughly, the other 65 per cent chewed quickly, superficially. Fast, restless eating was noticed in 67 per cent. Meals were eaten irregularly by 58 per cent.

EXPLANATIONS

That the percentage of men exceeds that of women, especially as ulcer patients, is by no means a chance finding, but is to be explained by the fact that women perform lighter work, eat more regularly, and are not prone to alcohol and tobacco abuses.

The greatest number of gastric patients are between thirty and forty years of age. This is surprising because at that age many of them have splendid teeth; while the ages between fifty and sixty-five, when the condition of their mouths is poor or very poor, show a smaller percentage of disease.

A marked difference between the diagnosis at the first examination and that at the last examination was found. The reason is that many ulcerous conditions developed from simple hyperacid gastritis (81 gastric ulcers). The gastric diseases prepondered, anyhow; intestinal disturbances contribute only an unimportant portion. The stomach must therefore be considered as the most vulnerable part of the whole digestive tract, not on account of a specific weakness, but because it is primarily exposed to the damaging results of wrong masticating—and eating methods.

The condition of the masticating apparatus must be most carefully considered. It shows that three to five years after the beginning of disease, 67 per cent of the patients, and, if dental restorations are also counted, even 75 per cent, possessed a satisfactory chewing mechanism, and the progress or the beginning of the disease cannot be attributed to the loss of teeth. Furthermore, 85 per cent of the patients demonstrated a satisfactory masticating efficiency, and only 6 per cent an unsatisfactory one.

However, thoroughness and care in chewing were in most instances sadly lacking; only 35 per cent chewed carefully, and 65 per cent chewed superficially, despite good teeth. The reason for this is twofold: first, the bad habit of fast eating, even if sufficient time is available; second, poor economic conditions, which induce people to eat quickly, often standing up, so that careful chewing is out of the question.

The treatment consists mainly of dietary regulations; their effect is enhanced by dental restorations, providing greater efficiency in mastication. This, however, is of little use unless accompanied by improvement of chewing and eating habits. The loss of teeth is of only minor importance in the etiology of gastrointestinal diseases. The real etiologic factors are: careless chewing, which does not utilize the masticating efficiency of the jaws; irregularly eaten meals; eating of dry foods; fast, restless eating. Proper diet consists not only of the correct quantity and quality of food, but also of regular mealtimes, and careful chewing.

News and Notes

American Society of Orthodontists

The thirty-fifth annual meeting of the American Society of Orthodontists will be held at the Edgewater Beach Hotel, Chicago, April 19-22, 1937.

PAUL G. SPENCER, President
1817 Austin Avenue
Waco, Texas

CLAUDE R. WOOD, Secretary
608 Medical Arts Bldg.
Knoxville, Tenn.

American Board of Orthodontia

A meeting of the American Board of Orthodontia will be held at the Edgewater Beach Hotel, Chicago, April 17, 1937. Orthodontists who desire to qualify for certificates from the Board should secure the necessary application blank from the secretary. The application must be returned to the secretary, together with any other required credentials, at least sixty days prior to the date of examination. Applications filed at the time of the Board meeting will have preliminary consideration, so that the applicant may be advised of the work required for his subsequent examination. Attention is called to the following resolutions adopted by the Board:

Any person desiring to make application to the Board for a certificate must have been in the exclusive practice of orthodontia for a period of not less than five years or an equivalent to be determined by the Board and based upon the following conditions:

1. He must be an instructor in orthodontia in a school satisfactory to the Board.
2. He must be an associate in the office of an orthodontist whose standing is satisfactory to the Board.
3. It is definitely to be understood that any person at the time of making application for a certificate shall be in the exclusive practice of orthodontia in his own name.

CHARLES R. BAKER, Secretary,
636 Church Street,
Evanston, Ill.

Eastern Association of Graduates of the Angle School of Orthodontia

The next meeting of the Eastern Association of Graduates of the Angle School of Orthodontia will be held March 15 and 16 in the Anatomical Laboratory of Western Reserve University, Cleveland. Arrangements for the program are in the hands of Dr. T. Wingate Todd and the staff of the Brush, Bolton and Associated Foundations.

E. SANTLEY BUTLER, Secretary,
55 Locust Avenue,
New Rochelle, N. Y.

New York Society of Orthodontists

The annual meeting of the New York Society of Orthodontists will be held March 15 and 16 in New York City at the Waldorf Astoria Hotel.

HENRY U. BARBER, JR., President,
5 East 57th St.,
New York City.

FRANKLIN A. SQUIRES, Secretary
Medical Centre,
White Plains, N. Y.

Thos. P. Hinman Midwinter Clinic

The twenty-third annual session of the Thos. P. Hinman Midwinter Clinic will be held at the Biltmore Hotel, Atlanta, on March 15 and 16.

C. C. HOWARD, Chairman

J. D. OSBORNE, Secretary,
Doctors Building,
Atlanta, Ga.

Cleveland Dental Society

The sixth annual two-day clinic meeting will be held May 3 and 4.

CARLYLE MUEHLHAUSER, General Chairman,
8812 Lorain Avenue
Cleveland, Ohio.

Southwestern Society of Orthodontists

The Sixteenth Annual Meeting of the Southwestern Society of Orthodontists was held January 17-20 at the Washington-Youree Hotel at Shreveport. Two charter members of the Society were honored—Dr. Paul Spencer of Waco, Texas, and Dr. William Flesher of Oklahoma City—for their important and valuable service to orthodontia as a whole and to the Southwestern Society of Orthodontists. Dr. Flesher is a past president of the American Society of Orthodontists and Dr. Spencer is the president of the American Society for 1936-1937.

The scientific program included: "President's Address" by Curtis W. Williams, Shreveport; "Coil Spring Technic" by E. B. Arnold and J. Stier Cunningham, Houston; "Betty's Crooked Teeth" (motion picture) by Frank P. Bertram, Director of Dental Health Education, Oklahoma State Department of Health; "Case Reports" by Harold E. Rice, Colorado Springs, and T. Wallace Sorrels, Oklahoma City; general clinics; "Treatment Technic" (ap-

pliance construction, bite plan, etc., motion picture), and actual appliance construction by Oren A. Oliver, Nashville; ''Malocclusion and Diagnosis'' by W. R. Humphrey, Denver; ''Construction of Removable Appliance'' by S. D. Gore, New Orleans; exhibits and clinics.

Southern Society of Orthodontists

The Fifteenth Annual Meeting of the Southern Society of Orthodontists was held January 25 and 26 at the Biltmore Hotel, Atlanta.

On Sunday evening at 5:30 P.M. the members and visitors of the Southern Society were guests of the Fifth District Dental Society of Atlanta. The program of the meeting included:

''Modern Methods of Orthodontic Treatment'' by George R. Moore, Ann Arbor; ''Osteological and Dental Observations on Indian Cranie From Saint Simon's Island, Georgia'' by James K. Fancher, Medical Director of the Good Samaritan Endocrine Clinic; ''Child Growth and Development'' by Glenville Giddings, Emory University; Symposium on Heredity: ''The Physical Basis of Heredity'' by Mary Stuart MacDougall, Agnes Scott College; ''Evidence of Heredity Factors in Dental Anomalies'' by A. LeRoy Johnson, New York City.

European Orthodontological Society

The next meeting of the European Orthodontological Society will be held in Brussels on May 17 and 18, 1937, under the presidency of Dr. Lucien De Coster. The Headquarters will be at the Palace Hotel. The scientific meetings will be held in the new Eastman Clinic buildings, by courtesy of Dr. Watry.

Communications from those who desire to contribute to the program may be addressed to

G. F. CALE-MATTHEWS, Hon. Secretary
95, Newhall Street
Birmingham, 3, England

Greetings to All Component Society and A. D. A. Members

The New Jersey State Dental Society gladly welcomes the opportunity of serving as host to the American Dental Association for its Seventy-Ninth Annual Meeting at Atlantic City during the week of July 12.

A most cordial invitation is extended to every member of the national organization to participate in what will undoubtedly be a high water mark in the annals of the American Dental Association.

Atlantic City during July will be at its best, and its facilities for successfully staging a national convention are unsurpassed. Its Municipal Auditorium, which is the largest and most completely equipped in the world, is centrally located, directly on the ocean front within easy walking distance of all hotels. Ample hotel accommodations are assured for all attending the convention at rates guaranteed by the hotels to be charged as stipulated.

The time selected for the meeting should prove ideal to plan a vacation trip to New Jersey's delightful seacoast, where, besides an unexcelled scientific program, there will be much in the line of entertainment for all dentists, as well as their wives and families.

The entire membership of the New Jersey State Dental Society is eager to have you come, and it is sincerely hoped that you will plan to be among those present.

J. Robert K. Moodey, President,
The New Jersey State Dental Society.

American Dental Assistants Association

The Thirteenth Annual Meeting of the American Dental Assistants Association will be held at Atlantic City, New Jersey, July 12-16. For further information address:

Lucile S. Hodge, General Secretary,
401 Medical Arts Building,
Knoxville, Tenn.